FINAL

Field Sampling and Analysis Plan

Test Well Installation at Unit 2 (RSA-13, RSA-14, RSA-132, and RSA-133) Redstone Arsenal, Alabama

EPA ID NO. AL2 210 020 742

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
Savannah District

MAY 13, 1994

Draft
Field Sampling and Analysis Plan
for
Test Well Installation at Unit 2
Redstone Arsenal, Alabama

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Contract No. DACA 21-91-D-0024

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SYMBOLS AND ABBREVIATIONS

LIST OF ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Standards for Testing of Materials
BNA	Base/Neutral/Acid Extractables
BOD	Biochemical Oxygen Demand
CESAS	Savannah District Corps of Engineers
CDAP	Chemical Data Acquisition Plan
CDQO	Chemical Data Quality Objectives
CFR	Code of Federal Regulations
C.I.H.	Certified Industrial Hygienist
COC	Chain of Custody
COD	Chemical Oxygen Demand
DERP	Defense Environmental Restoration Program
DQO	Data Quality Objective
EOD	Explosive Ordnance Disposal
EPA	US Environmental Protection Agency
FOL	Field Operations Leader
FSAP	Field Sampling and Analysis Plan
HSM	Health and Safety Manager
HSO	Health and Safety Officer
HTW	Hazardous and Toxic Waste
ICM	Interim Corrective Measure
I.D.	Inside Diameter
IRA	Interim Remedial Action
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MICOM	U.S. Army Missile Command
MRD	USACE Missouri River Division
msl	mean sea level
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
OB/OD	Open Burn/Open Detonation
PARCC	Precision, Accuracy, Reproducibility, Completeness and Comparability
P.E.	Professional Engineer
P.G.	Professional Geologist
PM	Project Manager
PP	Priority Pollutant
ppb	parts per billion
QA/QC	Quality Assurance, Quality Control
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSA	Redstone Arsenal
SS	Stainless Steel

SSHP	Site Safety and Health Plan
TCE	Trichloroethylene or Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOC	Top of Casing
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
UV	Ultraviolet
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Field Sampling and Analysis Plan (FSAP) combines the contents of a typical Chemical Data Acquisition Plan (CDAP) and Well Installation Plan. This FSAP describes the proposed Field Program at Unit 2, Redstone Arsenal, involving the installation of ten groundwater test wells. The purpose of the program is to further determine the design parameters for the Interim Corrective Measure (ICM) at Unit 2. Background information about the Unit 2 site and the proposed ICM is contained in the Unit 2 ICM Design Work Plan prepared by Ebasco. The purpose of this FSAP is to make certain that field work is performed in a manner which ensures that chemical analytical data acquired during the investigation are of sufficient quality to meet the intended usage. Data quality depends not only on how carefully an analytical method is carried out but also on the sample point selection, sampling procedures, sample integrity and analytical method selected. Additionally this FSAP describes the methodology to be used in installing the test/extraction wells, and to perform the aquifer and specific capacity tests.

This FSAP defines the project Data Quality Objectives (DQO). It describes the project organization and functional responsibilities and details the field activities and laboratory analytical procedures established to meet the DQO.

Development of this document was guided by a number of documents including the following:

- Chemical Data Management for Hazardous Waste Remedial Activities, USACE, 1 October, 1990.

- Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects, USACE memorandum, August 1989.

- Guidance for Data Usability In Risk Assessment, US EPA, October 1990.

- Installation of Groundwater Monitor Wells and Exploratory Borings at Hazardous Waste Sites, USACE, Missouri River Division, May 1990.

1.1 Background

The U.S. Army Missile Command (MICOM) Environmental Management Office of Redstone Arsenal, Alabama, has tasked the U.S. Army Corps of Engineers (USACE), Savannah District (CESAS) to conduct an interim remedial action (IRA) at Unit 2, the active Open Burn/Open Detonation area at Redstone Arsenal. The Interim Corrective

Measure (ICM) for this project involves the design and construction of a pump and treat system to prevent the spread of the existing trichloroethylene (TCE) groundwater plumes found at the site.

The CESAS has tasked Ebasco Environmental (Ebasco) under the Idenfinite Delivery Order Contract DACA 21-91-D-0024 to prepare design documents for the ICM at Unit 2. In order to facilitate design of the ICM, Ebasco will perform a field sampling program to obtain additional field data at the Unit 2 site.

1.2 Location

Redstone Arsenal (RSA) is a U.S. Army facility located in Madison County, Alabama, as shown in Figure 1-1. It is bounded on the north and east by the City of Huntsville, on the south by Wheeler National Wildlife Refuge and the Tennessee River, and on the west by agricultural, residential and light industrial areas.

Unit 2, the active Open Burn/Open Detonation (OB/OD) Area, is approximately 89 acres in size and is located in the southern portion of RSA near the Tennessee River (Figure 1-2). The OB/OD Area is used to dispose of explosive and explosive contaminated wastes. Previous investigations of this site indicate that both soil and groundwater contamination is present. TCE concentrations of approximately 100,000 parts per billion (ppb) have been encountered. The groundwater contamination is in two distinctly separate plumes which appear to be spreading radially.

1.3 Field Program Objectives

Ebasco was tasked in 1992 by the USACE to design an Interim Corrective Measure to begin remediation of contaminated groundwater at the Unit 2 site. During preparation of the Draft ICM Design, it became apparent that the characteristics of the limestone aquifer, as well as the chemical characteristics of the groundwater, were not sufficiently defined. Hydrogeologic uncertainties, such as aquifer yield and location of fracture zones currently make it very difficult to predict if the proposed extraction wells will penetrate a productive zone, and if the aquifer will yield the predicted flows and contaminant concentrations. Additional information about the total suspended solids, iron and metals concentrations also is needed to determine the magnitude of pretreatment required for the ICM system.

The purpose of this Field Program is to collect the additional data required to complete the design of the ICM. The scope of the proposed Field Program basically involves the installation of the extraction well network described in Section 2.0 of the Unit 2 ICM Design Work Plan [last revised May 1994], and the subsequent collection of chemical and physical data from those wells.

The physical data that will be obtained from this drilling and testing effort includes:

- Sediment and bedrock characteristics to allow for optimum well screen design.

- Aquifer hydraulics data to be used to project horizontal and vertical zones of capture and to project the quantity of water to be remediated.

- Groundwater quality data to be used to project future treatment requirements.

- Operational data from the pilot treatment system to establish design criteria for a full scale plant.

These data will be used to properly size the capacity of the groundwater treatment system. As stated in the Unit 2 ICM Design Work Plan prepared by Ebasco, it was necessary to use the Theis equation to estimate the potential radius of influence of an extraction well at the site. This information was essential in selecting the location, depth and screened interval of the test wells being installed during this field program. Once the raw data is obtained during this field program, it will not be necessary to use a model such as the Theis method to determine the aquifer characteristics at the site. The objective of this field program is to measure these characteristics directly. The direct measurements will be used to design the ICM.

Chemical analyses of extracted groundwater obtained during the Field Program will provide the data necessary to sufficiently characterize the groundwater contamination at the site. In particular, water quality parameters such as iron and total suspended solids are required to design a pretreatment system. Additional data to be collected will include analyses for metals and organics suspected of being present in the groundwater. These contaminants include all metals and organics detected during previous investigations.

At the conclusion of the Field Program, Ebasco will submit a Technical Report containing the results of the program and conclusions and recommendations for completion of the ICM Design.

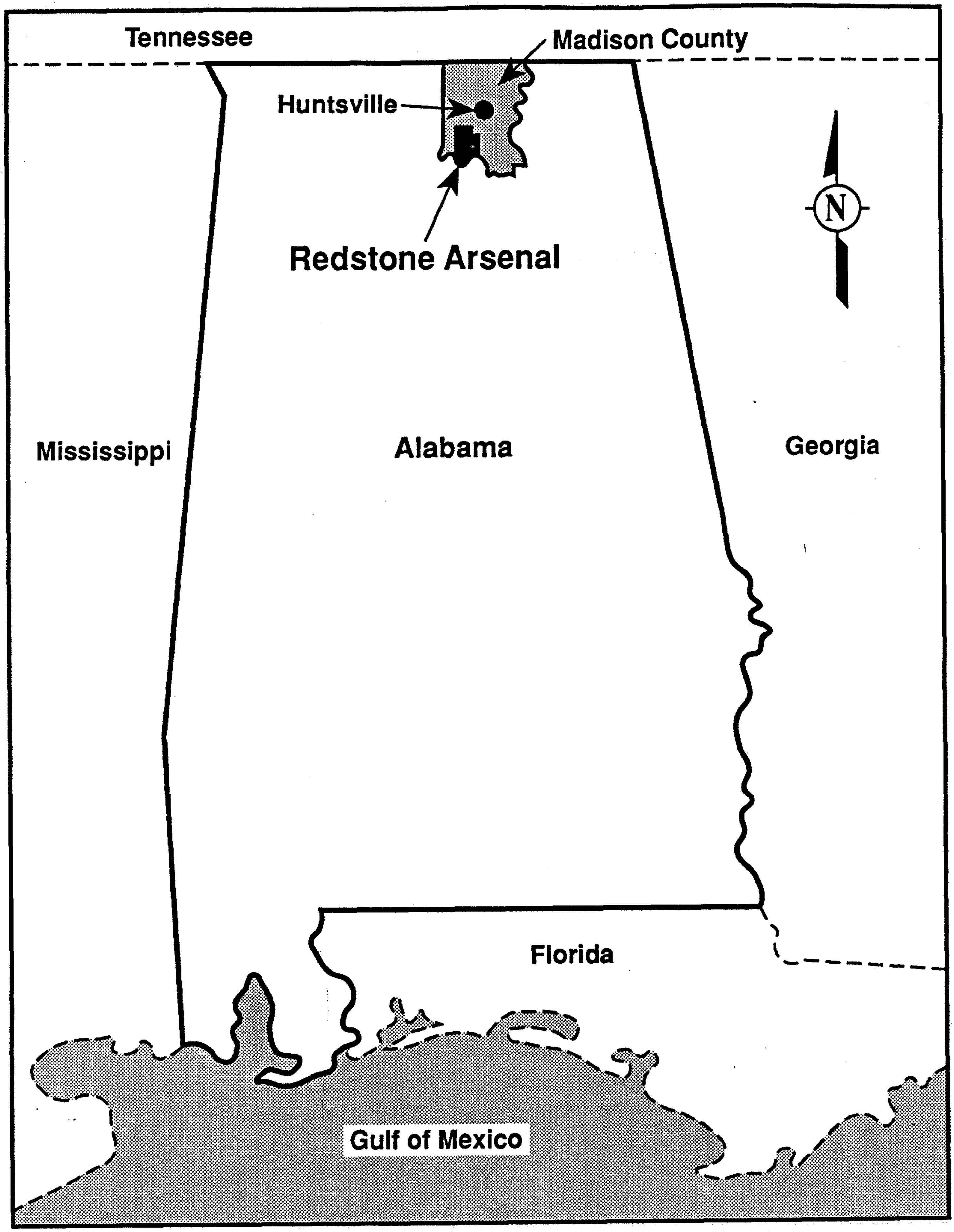


FIGURE 1-1 LOCATION OF REDSTONE ARSENAL

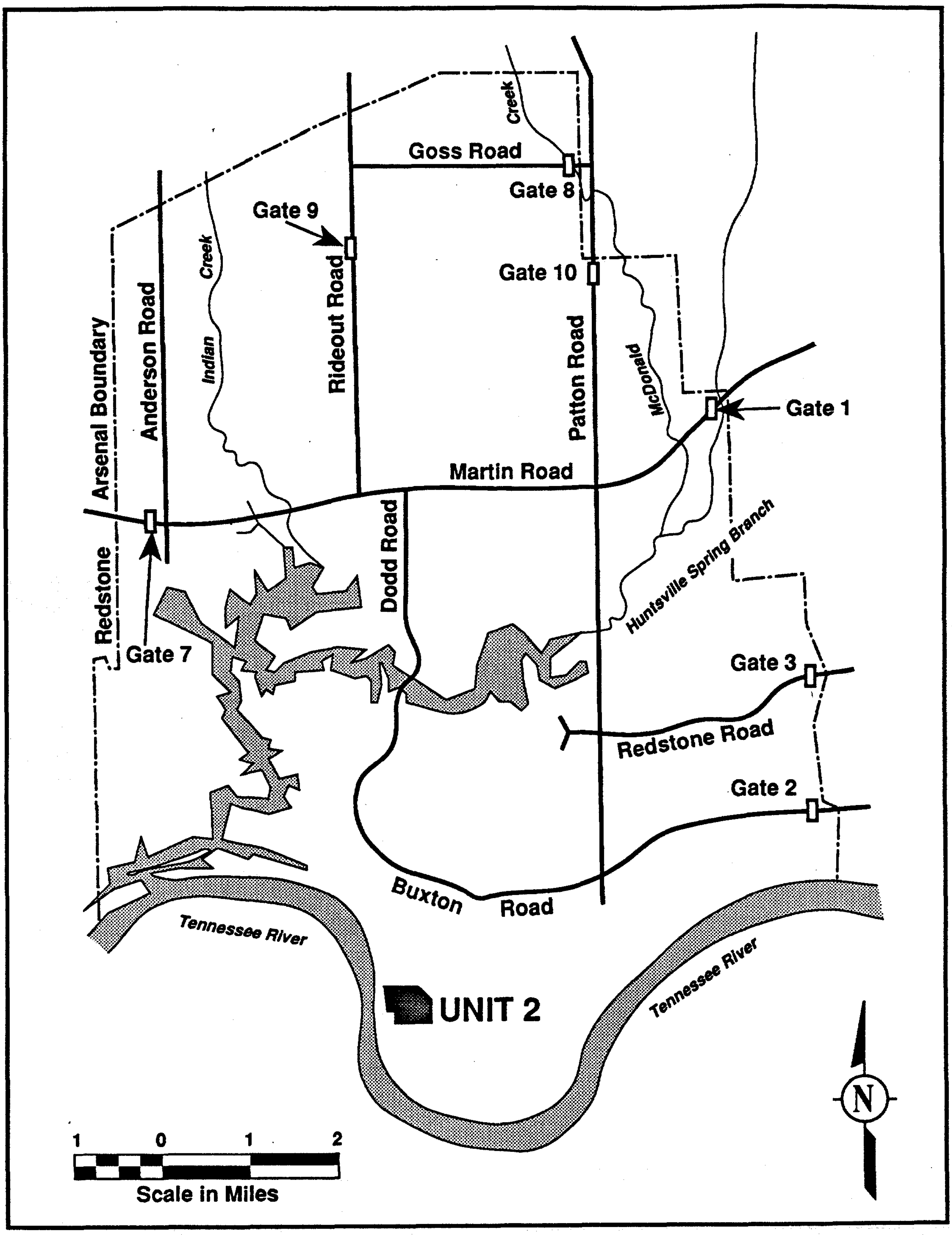


FIGURE 1-2 LOCATION OF UNIT 2

2.0 FIELD ACTIVITIES

2.1 Overview of Field Activities

Field activities to be performed at the Unit 2 ICM site consist of:

- Mobilization and location of utilities
- Subsurface exploration
- Installation of test/extraction wells
- Installation of piezometers
- Pump testing
- Well abandonment
- Land survey and water level survey
- Treatability study
- Sampling and analysis
- Decontamination/Demobilization

2.2 General Field Operations

2.2.1 Mobilization and Utilities Location

Upon approval of this plan, a field sampling crew and drilling contractor will be scheduled and equipment will be mobilized to the site. Site personnel will be thoroughly familiar with this FSAP, and the Site Safety and Health Plan (SSHP) prior to initiating field activities.

During field mobilization activities, Ebasco personnel will accompany RSA or other personnel qualified to locate underground utilities. Well locations will be repositioned if there is a conflict with underground utilities as identified by the utility locator and maps identifying underground utilities' locations. Allowances shall also be made for drilling near overhead utilities, wherever applicable.

2.2.2 Explosive Ordnance

In addition to locating utilities, the Ebasco Explosive Ordnance Disposal (EOD) Team will conduct a surface sweep and magnetometer survey of the site to ensure the safety of workers. This activity will be performed prior to any site work.

After the proposed well and piezometer locations have been marked, the access routes will be cleared, using a Schondstedt MG72, to a minimum width of 20 feet to allow the safe passage of equipment and vehicles to these locations. Each well installation work area shall be cleared, using a Schondstedt MG220, to a diameter large enough to permit equipment and vehicles to maneuver within the area to perform their mission while allowing sufficient room for safe access and egress. If unexploded ordnance (UXO) is encountered during the surface sweep, that area shall be red flagged to warn personnel to stay clear, and a new well location will be selected. The government will be notified if UXO is encountered at any time during the Field Program.

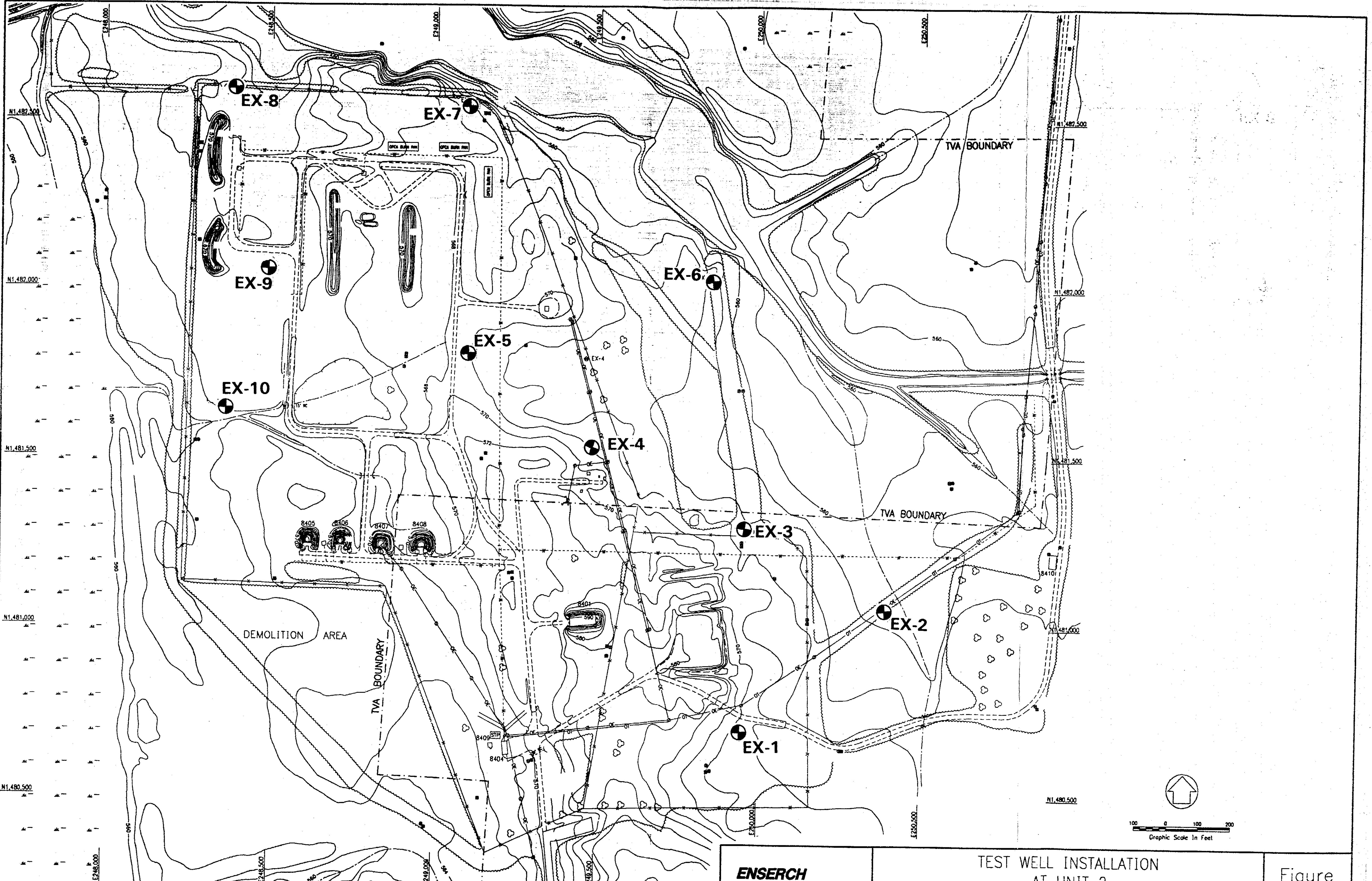
Prior to the start of any drilling, a magnetometer and hand-held auger shall be utilized to ensure that each of the drilling locations for test wells and piezometers is clear of subsurface UXO. At no more than a 2 foot depth, the hand-held auger shall be withdrawn and the magnetometer probe shall be lowered into the auger hole. This procedure will ensure that small UXO items (20 mm projectiles and grenades) undetectable from the surface, are now detectable. This procedure shall be repeated until the maximum depth of the hand-held auger is reached, (normally 5 to 6 feet).

Initial drilling shall be stopped every four (4) feet and the rig will be moved a minimum of 30 feet from the hole to eliminate magnetic influence of the drilling apparatus on the magnetometer. The hole will be checked with the magnetometer and if clear, the rig shall be repositioned over the hole to continue drilling. This procedure shall be followed until a minimum of 20 foot drilling depth has been reached. At the end of this safety procedure, the rig shall be allowed to begin normal drilling of the test wells and piezometers. These boreholes will be installed directly on top of the 4-inch boreholes previously screened for UXO.

2.2.3 Test/Extraction Well Installation

The locations of the ten proposed test wells are shown on Figure 2-1. Test wells will be installed to a maximum depth of 75 feet BGL. The borehole shall penetrate the limestone bedrock a minimum of 12 feet. After the borehole has been drilled, the well screen, attached end fittings and other appurtenances shall be attached by an approved manner to the casing, lowered into the boring with the casing, and properly centered. It shall in no instance be driven or forced, and shall remain suspended from the surface until the gravel pack has been added. The string of casing and screen shall be secured approximately 1 foot above the bottom of the borehole to allow the filter pack to form beneath the screen.

The casing will be 6-inch minimum (I.D.), schedule 80 polyvinyl chloride (PVC) pipe with thread and couple joints. The screen shall be 6-inch (I.D.), continuous "V" slot, wire-wrapped design, Type 304 stainless steel and shall be 20 feet in length. The screen slot size shall be carefully selected on the basis of a mechanical sieve analysis of the unconsolidated aquifer material and the artificially introduced filter pack material. Slot size will be such that less than 15 percent of the formation and filter pack can pass through the screen. The screened interval will span the interface of overburden and bedrock material.



PLOT DATE APRIL 1, 1994 FILENAME C:\REDSTONE\FIG-2-1.DWG

ENSERCH ENVIRONMENTAL CORPORATION

TEST WELL INSTALLATION AT UNIT 2

REDSTONE ARSENAL, ALABAMA

Figure 2-1

While the casing and screen remain suspended from the surface, the filter pack material and bentonite pellet seal shall be placed by the use of a tremie pipe. The filter pack material shall extend a minimum of 2 feet above the top of the screen. A graduated tape will be used to ensure proper depth. A five-foot bentonite pellet seal or bentonite slurry will be placed on top of the filter pack. The pellet seal (if used) shall be allowed to hydrate in accordance with the manufacturers specifications. The annular space above the bentonite shall be filled with cement grout.

Once the bentonite and grout have set for a period of at least 24 hours, each well will be developed to its maximum capacity by surging, jetting and/or pumping. A record of time, operation, pumping rate and sand content will be maintained. Each well will be developed for a minimum of 4 hours or discontinued when particle free water is produced. Photographs will be taken of the development water. Contaminated water produced during well development will be stored on site as described in Section 6.0 pending treatment onsite during the treatability study.

All test wells shall be fitted with a vented protective cap which will be designed to prevent contaminants from entering the well. The well riser will be surrounded by a larger diameter steel protective casing set into a concrete pad and rising 24" to 36" above ground level. The steel protective casing shall be provided with lock and cap. The cap for test wells shall be securely fastened to the well casing by means of the threaded connection.

Future plans at the Unit 2 site (for the ICM) include the installation of a vault around each well head. Therefore, no concrete pad or other structure will be installed around the well at this time. However, two (2) four-inch diameter bumper posts shall be installed next to the pad for each well. The bumpers shall extend a minimum of 3 feet above ground, be painted bright yellow, and be constructed of durable material.

2.2.4 Piezometer Installation

The drawdown at each installed well to be pump tested will be measured in at least three existing monitoring wells and/or new piezometers. If no or not enough monitoring wells exist nearby, new temporary piezometers will be installed. If new piezometers are required, they will be install approximately 20 and 40 foot away from the pump test well. Piezometers will be drilled with an auger to refusal. Casing for temporary piezometers will be 2 inch I.D. thread and couple joint PVC pipe. After the pump test is complete, the piezometer casing and screen will be removed, and the open hole will be grouted to the surface.

2.2.5 Pump Testing and Specific Capacity Testing

Three of the wells will undergo aquifer testing for 24 hours, each consisting of 20 hours of pumping and 4 hours of recovery. Specific capacity tests will be conducted on the seven remaining wells. Specific capacity tests will be conducted for a maximum of 4 hours. The contaminated water generated during these tests will be temporarily contained in open top and/or closed tanks and then treated during the treatability study. For each of the specific capacity tests, the well will be pumped at a rate such that the drawdown stabilizes at approximately 5 feet above the top of the well screen. Well yield will be measured with a flow meter and drawdown measured with a pressure transducer and data logger. Water level measurements will also be made in a near-by well if one exists. The test will be concluded after 4 hours of pumping. Water level recovery measurements will be made for two hours.

The three wells to be pump tested will be selected in the field. Wells will be evaluated during development to determine if yields will be favorable for pump testing. Wells in the areas of highest contamination (based on previous investigations) which demonstrate favorable yield will be selected.

The pump tests are designed to determine the hydraulic characteristics of the contaminated aquifer and provide the data to predict the well yield necessary to intercept the contaminants. The duration of a test should be sufficient to identify delayed drainage or boundary effects. Decidedly, a 72 hour pump test would provide more data about late-time drawdown; however, three tests having a duration of 24 hours per test have been selected due to project time constraints and the necessity of treating all of the extracted water on site.

During each pumping test the well yield will be monitored with a flow meter. The initial pump settings will be guided by the results of the specific capacity tests conducted on other wells. The discharge valve will be pre-set, to the degree possible, to achieve a constant rate of 25 gpm or a rate sufficient to result in a maximum drawdown close to the top of the well screen. The rate will be adjusted only when absolutely necessary to keep the water level a safe distance above the pump intake. If necessary, a test will be disconnected and restarted after the water level has recovered to its original static position.

Water levels in the pumped well and at least 3 nearby wells will be monitored with a pressure transducer and data recorder. Pretest measurements will be made for at least 2 hours before the pump is turned on and recovery measurements will be made for 4 hours after the pump is turned off.

2.2.6 Well Abandonment

As described in the Unit 2 ICM Design Work Plan, it is estimated from existing data that the aquifer underlying the site will yield an average of 25 gpm per well. Given the complex limestone hydrogeology; however, the actual flow from a well could vary from zero to 1,000 gpm, depending on whether or not the well intersects a productive fracture zone. For this design, it will be assumed that each well will produce from 15 to 35 gpm, for an average of 25 gpm. Based on this assumption, and during installation of the extraction wells, a boring which does not appear capable of being converted to an extraction well having a pumping capacity of 15 to 35 gpm will be plugged and abandoned. Two basic criteria will be used to determine if a borehole will be completed as a well or abandoned:

- During air hammer drilling, air forced into the borehole displaces groundwater from the aquifer to the surface. The amount of water produced can be measured. Experience indicates that the flowrate of displaced water is roughly twice the potential yield of the completed well. Based on this, the criteria for accepting a borehole for completion as a well will be that the water produced during air hammer drilling is at least 30 gpm.

- Cuttings produced during drilling will be examined and logged. In order for a borehole to be converted to a well, there should be a sufficiently deep layer of potentially permeable material above the top of the bedrock at that borehole location. This determination will be made in the field by the on-site geologist.

The abandonment procedure shall restore, as closely as possible, the geohydrologic conditions that existed before construction began and shall conform to the State of Alabama regulations for Well Abandonment. Wells shall be grouted from the bottom of the borehole to within 5 feet of the ground surface. The remaining 5 feet of borehole shall be backfilled with soil of the type originally removed from the boring.

2.2.7 Land Survey and Water Level

This project will require surveying services within and adjacent to the site. These services entail the surveying of horizontal locations and vertical elevations, test wells, piezometers and abandoned boreholes. Survey data will be to 3rd order standards and will reference existing on-site monuments and/or permanent well disks which are tied to the Alabama State Plane Coordinate System and the North American Vertical Datum of 1929. Well designations will be obtained from the MICOM Environmental Management Office, Redstone Arsenal. Resulting coordinates and elevations will be submitted in hard copy, added to the existing Unit 2 Topographic Survey computer file, and plotted on the Unit 2 ICM Design Drawings.

Water levels in each of the test/extraction wells will be measured from the top of casing (TOC) and recorded in the field logbook. This activity will precede sampling and shall provide information regarding groundwater flow direction.

2.2.8 Treatability Study

As described in the Unit 2 ICM Design Work Plan, the treatment method proposed for the full scale ICM is advanced oxidation using ultraviolet (UV) light and hydrogen peroxide H_2O_2. During the Field Program, Ebasco will provide a pilot scale version of the UV/H_2O_2 Oxidation system to treat contaminated groundwater extracted from the installed test wells. The purpose of the pilot scale system is twofold: it will provide onsite treatment of the generated water, and it will be used to conduct a treatability test to establish the operating criteria for the full scale ICM system.

The study will be conducted to achieve the following objectives:

- Determine pretreatment or post-treatment requirements.
- Determine chemical requirements and UV light intensity.
- Establish the design criteria for a full-scale plant.
- Develop operating parameters and procedures.
- Develop cost information including equipment and operating and maintenance costs.
- Demonstrate that the UV/H_2O_2 technology is capable of meeting discharge criteria.

During the pilot study, groundwater flow rates, UV dosage, and the concentrations of chemicals such as H_2O_2 will be varied to determine key design and operating variables for a full-scale UV/H_2O_2 Oxidation System. Samples of the system influent and effluent will be taken for each variation and analyzed to determine the effects of the different operating variables.

Pretreatment criteria for carbonate and bicarbonate hardness, iron, solids and pH will also be determined during this study.

After the pilot test system is in the steady-state and treatment is carried out for appropriate retention times, periodic samples of the treated and untreated water will be collected for analysis. The samples will be shipped on ice to a designated laboratory for analysis by EPA method 601. All sample shipments will be accompanied with chain-of-custody (C-O-C) documentation.

Well development, pump testing and specific capacity testing will produce a substantial amount of contaminated groundwater (approximately 350,000 gallons). A portion of this water will be used as influent for the treatability study. The remainder will be fed to the treatment system as described in Section 2.2.9.4.

2.2.9 Sampling and Analysis

2.2.9.1 Soil Sampling and Analysis

Auger cuttings generated during test well construction will be stored in roll-off boxes provided at the site. In order to determine proper disposal procedures, one composite soil sample will be collected from each roll-off box and sent to a designated laboratory for analysis. The method of analysis and the parameters to be analyzed are summarized in Table 2-1.

2.2.9.2 Sludge Sampling and Analysis

A small quantity of sludge is expected to result from the treatment of groundwater on-site. This is due to the removal of solids from the water on pre- and post-treatment filters. Sludge generated during the project will be contained in a 55 gallon drum(s). The sludge will be allowed to settle. Once it has separated, the liquid portion will be decanted and recycled through the treatment system. A bulk sample will then be collected from the remaining bottom sediment and analyzed for the parameters shown in Table 2-1.

2.2.9.3 Groundwater Sampling and Analysis

Groundwater from each test well will be collected for sampling during the pump test or specific capacity test, as applicable. Three samples per well will be collected. One sample will be collected at the end of the first hour of pumping. A second sample will be collected at the mid-point of the pumping cycle. The third sample will be collected 30 minutes prior to the end of the pump/specific capacity test. All samples will be sent to a designated laboratory for analysis. Table 2-2 summarizes the method of analysis, parameters to be analyzed and the number of samples to be analyzed.

2.2.9.4 Treatability Study Samples

The pilot scale treatment system parameters will be varied during the first week of system operation as described in Section 2.2.8. Three different combinations (treatability tests) will be performed. For each treatability test, the system will be allowed to reach a steady-state and appropriate retention times will be carried out. Once steady-state has been reached, three influent water samples and three or more effluent water samples will be collected per test, for a total of approximately 20 samples. Two additional samples will be collected for quality control. The samples will be collected, in duplicate, in 40 ml vials and shipped to the laboratory for analysis. Table 2-3 summarizes the number of samples, parameters to be analyzed and methods of analysis. Treated water generated during treatability testing will be sampled and recirculated through the system until lab analyses indicate that the water meets NPDES permit discharge requirements.

2.2.9.5 Performance Monitoring and NPDES Samples

It is estimated that approximately 350,000 gallons of groundwater will be generated by development, pump testing and specific capacity testing. A portion of this water will be treated during the treatability study. The remaining water will be fed to the treatment system following completion of the treatability study. The performance of the system will be monitored during this time. The system will be operated intermittently, as water is generated from pump tests and specific capacity tests. Each time the system is turned on, and once operation has stabilized, samples will be collected from the influent and effluent ports and analyzed for volatile organic compounds (VOCs) and other parameters required by the National Pollutant Discharge Elimination System NPDES Permit. The number of samples, parameters and laboratory methods are shown in Table 2-4. A brief discussion of NPDES permitting is contained in Section 6.0.

TABLE 2-1
REDSTONE ARSENAL
DRILL CUTTING, OTHER IDW SOIL, AND SLUDGE SAMPLES

Matrix	Parameter	Method No.	Turn-around Time	Estimated No. of Samples*	DQO Level
Soil or Sludge	Explosives	8330	2 Weeks	6	III
	TCLP-Complete List	1311	2 Weeks	6	III
	Flash Point	1010	2 Weeks	6	III
	Corrosivity	9045	2 Weeks	6	III
	Reactivity	Chapter 7.3	2 Weeks	6	III

TABLE 2-2
REDSTONE ARSENAL
PUMP TEST/SPECIFIC CAPACITY TEST SAMPLES

Matrix	Parameter	Method No.	Turn-around Time	Estimated No. of Samples*	DQO Level
Water	VOCs	8240	2 Weeks	35	III
	PP Metals	6060/7470 7740/7421 7060/7471	2 Weeks	35	III
	Mn	7460	2 Weeks	35	III
	Fe	7380	2 Weeks	35	III
	CO_3	403/2320	2 Weeks	35	III
	Turbidity	180.1	2 Weeks	35	III
	pH	150.1	2 Weeks	35	III
	TSS	160.2	2 Weeks	35	III
	TDS	160.1	2 Weeks	35	III

TABLE 2-3
REDSTONE ARSENAL
TREATABILITY STUDY SAMPLES

Matrix	Parameter	Method No.	Turn-around Time	Estimated No. of Samples*	DQO Level
Water	VOCs	8240	24 Hour	22	III
	Fe	7380	24 Hour	22	III
	TSS	160.2	24 Hour	22	III
	COD	410.1	24 Hour	22	III
	pH	150.1	24 Hour	22	III

TABLE 2-4 REDSTONE ARSENAL NPDES AND PERFORMANCE MONITORING SAMPLES					
Matrix	Parameter	Method No.	Turn-around Time	Estimated No. of Samples*	DQO Level
Water	VOCs	8240	4 Weeks	11	IV
	PP Metals	6060/7470 7740/7421 7060/7471	4 Weeks	11	IV
	BNAs	8270	4 Weeks	11	IV
	Explosives	8330	4 Weeks	11	IV
	Ammonia	350.1	4 Weeks	11	IV
	Fe	7380	4 Weeks	11	IV
	TSS	160.2	4 Weeks	11	IV
	BOD	405.1	4 Weeks	11	IV
	COD	410.1	4 Weeks	11	IV

* Note: This includes QC samples.

During sampling at each port, water will be allowed to run for 10 seconds into a 5-gallon bucket before filling the appropriate sample bottle. This will ensure that the water collected represents flowing water within the system and not stagnant water within the sampling port. The water discharged into the bucket will be recycled back into the treatment system.

Water samples collected for VOC analysis will be discharged directly into preserved 40 ml glass vials at a very low flow rate so that air will not be entrained in the sample. Sample bottles will be filled to the top to minimize aeration of the samples. The container will then be turned upside down and gently stuck on the sampler's hand to check for bubbles. If air is present, that sample will be discarded and new samples will be collected until a sample is collected that is free of air bubbles. The remaining, pre-preserved sample bottles will then be filled. Samples will be handled and shipped according to procedures described in Section 5.0.

QA/QC requirements for performance monitoring will include one split sample sent to the USACE QA laboratory and one blind duplicate sample sent to the contractor laboratory for every 10 samples taken. One VOC trip blank, prepared by the laboratory, will be included in each cooler for shipment containing VOC samples. Sufficient quantity for matrix spike/matrix spike duplicates will be collected approximately every 20 samples. A pre- and post-preservative blank sample, as well as equipment rinseate blank samples will be collected.

2.2.10 Decontamination

All drilling and sampling equipment will arrive at the site clean and in good working condition. Drilling and sampling equipment, including appropriate portions of the drill rig, augers, drill casing, rods, tools, etc. will be decontaminated between each drilling event to prevent potential cross-contamination of soil and groundwater.

Decontamination will be conducted on a decon pad constructed in the field. The pad will be designed so that all water and soils resulting from the decontamination process can be captured and transferred to storage containers. The disposition of contained decon water is discussed in Section 6.0.

Tools and equipment will be decontaminated using the following procedures:

- Steam clean equipment;
- Rinse with potable water;
- Air dry all equipment;
- Wrap in aluminum foil or plastic (if equipment is not to be used immediately).

All sampling equipment that comes in direct contact with an analytical sample and is not disposable will be decontaminated prior to each sampling episode using the following procedure.

- Scrub equipment with a low-sudsing, non-phosphate detergent in potable water;
- Rinse with potable water;
- Rinse with 0.1N nitric acid solution (4.2 ml of conc. reagent grade nitric acid added to 1000 ml deionized water); and
- Rinse with distilled water to sufficiently neutralize.

3.0 EBASCO PROJECT ORGANIZATION AND FUNCTIONAL AREA RESPONSIBILITIES

3.1 Project Organization

The Program Manager, David Schaer is responsible for the quality of all work performed under USACE Contract DACA 21-91-D-0024. Kim Veal serves as the Project Manager (PM). The PM has primary responsibility for implementing the investigation. The PM is supported by the Field Operations Leader (FOL) and the Field Health and Safety officer (HSO). The FOL is responsible for onsite management of activities during the field investigation. Bruce Raabe will be the FOL. John Walker will be the HSO.

Additional project personnel are listed on Table 3-1. This table also denotes quality control officers. Resumes of all Ebasco personnel are provided in Appendix A. All Ebasco field personnel are hazardous waste health and safety trained and medically monitored.

3.2 Quality Assurance/Quality Control

Project quality assurance and quality control will be performed under the direction of Mr. Ashton Pearson from Ebasco's corporate QA/QC group. The project QA officer will be Sue Jones who is responsible for laboratory activities. Additional details are provided in Sections 4 and 5 of this plan.

All project personnel are responsible for ensuring the quality of work on the project. Project quality control officers are identified in Table 3-1. Each officer is responsible for the quality of work performed under their direction. Mr. Schaer is responsible for quality control at the program level and Ms. Veal is responsible for the quality of work at the project level. Mr. Raabe is responsible for quality control in the field.

3.3 Analytical Laboratories

(TBD) will be utilized during this project to provide for all analyses identified in Tables 2-1 through 2-4. Their current USACE Missouri River Division (MRD) validation will be provided to the Corps Project Manager upon request.

TABLE 3-1

EBASCO PROJECT PERSONNEL

Program Manager

David Schaer*

Project Manager

Kim Veal*

Field Operations Leaders

Bruce Raabe*

Health and Safety Officer

John Walker

Corporate Health and Safety

Gerry Delaney
Diane Morrell

Corporate QA/QC

Ashton Pearson

QA Officer

Sue Jones

* Quality Control Officers

4.0 CHEMICAL DATA QUALITY OBJECTIVES (CDQO)

The primary objective of field sampling for this project is to collect and analyze environmental samples to determine the quality of influent water to the water treatment system and compliance with National Pollutant Discharge Elimination System (NPDES) permit requirements for the effluent. To achieve this objective, a multi-step process is used to develop site-specific CDQO needed for this task. CDQO are developed to ensure that:

- Data needs for the engineering requirements are met.
- Alabama and Federal Applicable Relevant and Appropriate Requirements (ARARs), risk-based criteria, and data needs for engineering requirements are met.
- Samples are analyzed using well defined methods that will provide confident detection limits sufficiently below the NPDES permit conditions and Federal ARARs.
- The precision and accuracy goals of data are well defined and adequate to provide defensible data.
- Samples are collected using approved techniques and are representative of existing environmental conditions.
- Quality Assurance/Quality Control procedures for both field and laboratory methodology meet the USACE guidance document requirements.

Data Quality Level III was selected for this project because of the nature of the investigation. This level of quality represents data generated under laboratory conditions using USEPA-approved procedures. This type of data is used for determination of source, extent, or characterization of contaminants and to support evaluation of remedial technologies and treatability studies, if applicable. These data are both qualitative and quantitative. The specifics of the chemical data quality objective as it applies to field and laboratory procedures are discussed in the quality assurance/quality control section of this FSAP.

In addition to the general level of effort required for DQO III, there are additional factors that will aid in judging the quality of the data. The first of these is the use of split samples. To judge reproducibility and the quality of data from the contractor laboratory, samples will be split in the field and also sent to the MRD laboratory in Marietta, Georgia. Upon evaluation of these samples and receipt of contract lab data, the MRD lab will generate a QA report of its findings. The contractor laboratory will be required to have a current MRD validation that involves onsite inspections and successful evaluation of performance samples.

5.0 FIELD AND LABORATORY DATA MANAGEMENT

5.1 Field Documentation

During drilling of each boring, a daily detailed driller's report will be maintained and be available upon request at the well site. The report shall give a complete description of all number of feet drilled, number of hours on the job and dates, shutdown due to breakdown, and water level encountered.

During drilling of each boring a drill log will be kept by a qualified geologist setting forth the following parameters:

- Results of UXO screening;
- The reference point for all depth measurements (formations, samples, total depth, etc.);
- Depth of each change of stratum and stratum thickness;
- Identification of material from each stratum (according to USCS);
- Hole instability, special drilling problems, odors, and evidence of contamination;
- The depth at which the first water was encountered; and
- The depth at which bedrock was first encountered.

During groundwater sampling, the date, time, appearance of the sample (e.g. turbidity), and any other significant information about the sample will be recorded on the field logbook. Each sample collected will have its own number, which will apply during the duration of the project. The sample numbers will consist of a multi-faceted alpha-numeric code, that will identify: 1) the area of investigation, 2) the site designation, 3) the type of sample, and 4) the sample location.

The sample codes and types are:

RSA - Redstone Arsenal
SS - Soil Sample
QA - USACE QA Split
TB - Trip Blank
FB - Field Blank
TW - Test Well
SP - Sample Port
TS - Treatability Sample

All the sample locations will begin with a "RSA" designation indicating the sample is from Redstone Arsenal, and will be followed by the site designation number. For example, when sample port 01 (SP-01) is sampled at Unit 2, the number shall be:

RSA-Unit 2-SP-01

QA/QC Sample Designation: Blind duplicate samples will be designated with a fictitious sampling port number followed by the date of sampling, e.g., SP-103/10-1-93. USACE split samples will be designated by the actual sampling port number followed by an S and then the date, e.g., SP-001S/12-1-94. Trip blank samples will be designated TBS followed by the relative number 1,2,3, etc. for first, second, third, etc. sample, and the date (e.g. TBS-3/8-20-93). Matrix spike/matrix spike duplicate samples will be labeled the same as the original sample, followed by MS/MSD, and the date (e.g. SP-002 MS/MSD/8-20-83). Table 5-1 lists the QA/QC samples necessary for the treatment system prove-out and performance monitoring.

As field activities progress it may become necessary to alter the procedures outlined in this FSAP to respond to field conditions. Any changes or deviations from this FSAP will be documented by the FOL in the site logbook and a Field Change Request (FCR) Form initiated (see Figure 5-1). The FCR will be signed by the Project Manager, distributed to the Program Manager, the USACE Project Manager and the project file. A copy will also be kept in the onsite office trailer with the FSAP. Major changes will be discussed with the USACE Technical Manager (TM) before implementation.

A copy of the field logs shall be submitted to the USACE Project Manager following completion of the Field Program.

FIGURE 5-1
FIELD CHANGE REQUEST
-TYPICAL-

Site Name   Ebasco Charge Number   Field Change Number

____

To________________ Location________________ Date____________

Description:

____
____
____

Reason For Change:

____
____
____

Recommended Disposition:

____
____
____

____
Field Operations Leader (Signature)   Date

Disposition:

____
____
____

____
Project Manager (Signature)   Date

Distribution: Program Manager

Others as required: ____________
USACE Project Manager ____________
Quality Assurance Manager ____________
Project File

TABLE 5-1

ANALYTICAL METHODS AND DATA QUALITY OBJECTIVES

Matrix	Parameter	Analytical Method	Quantitation Limit (μg/L)	Precision (RPD)	Accuracy (%R)
Water	VOCs	8240	5-1000	*	*
	BDD	405.1		*	*
	COD	410.1		*	*
	TOC	415.1		*	*
	TSS	160.2		*	*
	Ammonia	350		*	*
	Chromium	6010		*	*
	Copper	6010		*	*
	Lead	7421		*	*
	Mercury	7470		*	*
	Nickel	6010		*	*
	Selenium	7740		*	*
	Silver	6010		*	*
	Thallium	6010		*	*
	Zinc	6010		*	*
	TRPH	418.1		30	75-125

* To be calculated upon receipt of analytical results.

5.2 Sample Handling

To maintain and document sample possession, chain-of-custody (C-O-C) procedures are required. These procedures are necessary to insure the integrity of samples from collection to data reporting. C-O-C provides the ability to trace possession and handling of samples from the time of collection through analysis and data deposition.

A sample is considered under custody if:

- It is in your possession; or
- It is in your view after being in your possession; or
- It was in your possession and you locked it up; or
- It is in a designated secure area.

Personnel collecting samples are personally responsible for the care and integrity of these collected samples until they are properly transferred or dispatched. Therefore, the number of people handling a sample will be kept to a minimum.

The C-O-C Form (Figure 5-2) will be completed by the sampler. The sampler will sign the form where indicated and record site identification, sample number, date and time of sampling, sample location, and requested analysis for each sample collected. The FOL will check off each sample analysis required on the C-O-C Form and check the sample label and C-O-C record for accuracy and completeness.

When transferring custody of samples, the individuals relinquishing custody and receiving custody will sign, date, and record the time on the C-O-C Form. The C-O-C Form documents the transfer of samples from the sampler to the analytical laboratory. Upon receipt of shipment at the laboratory, a designated sample custodian will accept custody of the samples and verify that information on the sample labels matches the C-O-C Form. Pertinent information on shipment, pickup, courier, date, and time will be recorded on the record. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

Based on existing information, it is not anticipated that any environmental samples will be hazardous enough to warrant special considerations for packaging and shipping. Samples will be shipped for overnight delivery in waterproof coolers using the following procedure:

- Place about 3 inches of inert cushioning material such as vermiculite in the bottom of a plastic bag-lined cooler.

- Enclose the sample bottles in clear plastic bags through which sample labels are visible and seal the bag. Place bottles upright in the cooler in such a way that they <u>do not touch</u> and will not touch during shipment.

- Put in additional inert packing material to partially cover sample bottles (more than halfway). Place bags of ice around, among, and on top of the sample bottles. If chemical ice is used, it should be placed in a plastic bag.

Fig. 5-2

EBASCO SERVICES INCORPORATED
CHAIN OF CUSTODY RECORD

PROJECT																		
SAMPLERS: (Signature)																	PRESERVATION	
SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	NO. CONTAINERS	P P METALS	P P MERCURY	BASE/NEUTRAL EXT.	ACID EXT.	VOLATILE ORG.						REMARKS OR SAMPLE LOCATION	ICED	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN

Relinquished by: (Signature) 1	Date / Time	Received by: (Signature)	Relinquished by: (Signature) 4	Date / Time	Shipped via:
Relinquished by: (Signature) 2	Date / Time	Received by: (Signature)	Received for Laboratory by: (Signature)	Date / Time	Shipping Ticket No.
Relinquished by: (Signature) 3	Date / Time	Received by: (Signature)	Remarks		

- Fill cooler with cushioning material.
- Put paperwork (chain-of-custody record) in a waterproof plastic bag and tape it to the inside lid of the cooler.
- Tape the drain shut.
- Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- Attach completed shipping label to top of the cooler.
- Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides.
- Affix numbered and signed custody seals on front right and back left of cooler. Cover seals with wide, clear tape.

All samples will be shipped to the laboratory on the day the samples are taken. Samples will be stored at 4°C, with a trip blank stored with all aqueous volatile organic samples from the time of sample collection. If sample integrity if compromised by the Contractor holding samples or allowing coolers to run out of ice, the sites will be re-sampled at no cost to the government.

5.3 Laboratory Analytical Program

5.3.1 Laboratory Analytical Procedures

The samples collected will be analyzed using the methods specified in USEPA SW-846, "Test Methods for Evaluating Solid Wastes" and "Methods for Chemical Analysis of Water and Wastes" EPA 600/4-79-020 (1983). This section is designed to provide information on analysis type, sample preparation, analytical methods, and QA/QC information necessary to achieve the project goals.

5.3.2 Method Data Quality Objectives

This section is intended to discuss data quality objectives as applied to the various methods for sample analyses. Analytical methods are selected based on the precision, accuracy, reproducibility, completeness, and comparability (PARCC) parameters necessary to satisfy the intended end use. The criteria used for evaluation of data quality is dependent on the specific analytical method which will contain method-specific quality control requirements.

The description and procedures to assess the PARCC parameters of the measurement data are discussed in the following section. The objectives for the PARCC parameters are shown in Table 5-1.

Precision

The measurement of precision will be performed for both sample collection and laboratory analysis procedures. The goal of this evaluation is to determine how much the quality of data is affected due to variation associated with field and/or laboratory techniques. For the purpose of evaluation, precision data will be obtained by calculating Relative Percent Difference (RPD) for field and laboratory duplicate sample results. The formula to be used is as follows:

$$RPD = \frac{|R_1 - R_2|}{(R_1 + R_2) / 2} \times 100$$

Where R_1 and R_2 are initial and duplicate results, respectively.

Accuracy

Accuracy measures the bias in a measurement system. The measurement of accuracy will be performed in accordance with specifics provided in the analytical methods. For all analyses, one field sample in an analytical batch (20 samples) will be spiked with a known amount of arsenic and percent recoveries will be calculated. The general formula for calculation of accuracy is as follows:

$$\%R = \frac{\text{Concentration of spike found} \times 100}{\text{Concentration of spike added}}$$

Additionally, laboratory control samples will be run at least once during every batch analysis.

Representativeness: Representativeness expresses the degree to which sample data accurately and precisely represent an environmental condition. This criteria will be met by making certain that sampling locations are selected and samples are collected properly.

Comparability: Comparability is a qualitative parameter expressing the confidence with which one set of data can be compared with another. For this project, comparability will be measured by ten percent of actual field samples being split between the USACE laboratory and Ebasco's contracted laboratory. In accordance with the Statement of Work for this project, samples will be shipped to the USACE laboratory for monitoring of the contract laboratory. The results of these samples will be reviewed by USACE and final recommendations provided to the USACE Project Manager for action, if necessary.

Additionally, the following measures will be taken to further ensure the comparability of the data:

- Appropriate selection of sampling and analysis procedures.
- Standardized written sampling and analysis procedures.
- Standardized handling and shipping procedures for all collected samples.

Completeness: Completeness is the percentage of reported analytical data that is usable. This procedure should be performed and determined during data validation. Ebasco will achieve a high level of completeness by ensuring that work is performed by well-trained personnel who know the project-specific objectives in both the field and laboratory. Furthermore, the guidance document requirements for QA/QC will be employed to help define and maintain the data quality level for the project. The USACE can expect to obtain a completion percentage of at least 90. The remaining data may be rejected by validation processes.

5.3.3 Laboratory Analytical Methods and Reporting

Samples will be prepared and analyzed using the methods specified in Tables 2-1 through 2-4. The methods selected are from "Test Methods for Evaluating Solid Wastes" (USEPA SW-846, third edition) and "Methods for Chemical Analysis of Water and Wastes" (USEPA 600/4-79-020, 1983). The details of the sample preparation and analysis techniques are contained in the respective method documentation as referenced above.

The laboratory will submit to Ebasco a data package that will include but not be limited to summaries of sample and quality control results, a narrative section addressing unusual events, and C-O-C information. A complete validated data package will be submitted by the Ebasco at the completion of the project.

5.4 Chemical Data Quality Assurance/Quality Control

The collection of samples and the analyses of the samples for this project will include quality control samples designed to monitor general techniques and practices. The field and laboratory quality control samples will comprise approximately ten percent (10 %) of the total field samples. Evaluation of the results of the impact on actual field samples will be the responsibility of the USACE QA Group. The report of their findings will be submitted to Ebasco for project applications. Details of how the QC samples will be applied are discussed in the proceeding section of this text.

5.4.1 Field Quality Control Samples

Field QC samples will be used to monitor the techniques used during sample collection, shipment, and equipment/container cleaning. The following QC samples will apply for the field activities:

Trip Blanks: Trip blanks will be used to determine potential cross-contamination resulting from the transportation and storage of samples. The blank will consist of organic-free reagent water originated by the laboratory in appropriate sample containers. Trip blanks will be shipped and stored with aqueous VOC samples from the time of collection to analysis. The analysis of the trip blank will be for VOC only. Trip blanks will be sent with every cooler of aqueous VOC samples to both the USACE QA laboratory and the contractor laboratory.

Split/Duplicate Samples: Split samples are samples that are collected as a single sample then homogenized, divided, and placed in two separate sets of containers. Duplicates are multiple grab samples, collected separately, that equally represent a medium at a given time and location. A minimum of 10 percent each split and duplicate samples will be shipped for quality assurance purposes to the USACE QA laboratory for splits and contract laboratory for duplicates.

5.4.2 Laboratory Quality Control

Method Blank: Each analytical batch will contain at a minimum one method blank. Generally, the blank will consist of laboratory grade water carried through the analytical process as if it were an actual environmental sample. This analysis will measure any laboratory generated contamination.

Matrix-Spike/Duplicate Samples: Matrix-spiked samples, which are known in organic analysis as matrix spike/matrix spike duplicate, and in inorganic analysis as duplicate and spike samples will be used to evaluate precision and accuracy. Spiked samples will be applied one in every twenty actual field samples per matrix. Triple volume of sample will be collected at this frequency and spiked at the laboratory. The inorganic duplicate is split in the laboratory and then analyzed as if it were a regular sample.

Surrogate Samples: For GC/MS analyses, designated concentrations of surrogate compounds will be added to each sample prior to sample preparation to determine method compliance. The GC/MS methods give criteria for surrogate recoveries on each sample which are used to determine if the sample must be reanalyzed.

Calibration Procedures and Frequency

Initial Calibration: On the first day of analysis for a given analytical method, the instrument will be calibrated as specified in the method. A minimum coefficient of correlation of 0.995 will be used unless specified by the method or alternative evaluation technique provided.

Daily Calibration: On subsequent days daily calibration will be performed if no other analytical activities were conducted on the instrument in the interim period. Daily calibration will consist of the analysis of one of the standards. This determination must agree within two standard deviations or 25 percent of the mean of previous calibration standards at chosen concentrations. If the calibration standard is not within these two determinations, the standard will be reanalyzed. If the results of the second determination still do not fall within the guidelines, the analyses will be considered invalid, and the samples will be reanalyzed after initial calibration is reported.

Preventive Maintenance: All standards are purchased from commercial suppliers and are traceable to the National Institute of Standards and Technology. Preparations and dilutions made in the laboratory are documented for this use. Dates are placed on all standards when they arrive, and records showing when the standards are opened and used are also documented.

The laboratory will periodically maintain and calibrate its major equipment including gas chromatograph/mass spectrophotometer, gas chromatograph, atomic absorption spectrophotometer, inductively coupled plasma spectrophotometer, etc. This maintenance requirement will apply to all test and measurement equipment used in the laboratory. A spare parts inventory is maintained for all major equipment.

All equipment maintained and calibrated will have an assigned record number permanently affixed to the instrument. A label will be affixed to each instrument showing: description, manufacturer, model number, serial number, date of test calibration or maintenance, by whom it was calibrated/maintained, and due date of next service. Calibration reports and compensation or correction figures will be maintained with the instrument.

5.5 Corrective Actions

Corrective action will be taken when practices, procedures, or documentation are not in conformance with project direction, goals, or USACE QA requirements. Such actions are most effective if discrepancies are recognized and resolved at the lowest level since, at these levels, the actions tend to be most immediate.

In accordance with this philosophy, when a discrepancy in the analytical system is observed, actions will be designed to correct the problem immediately and to bring the system into conformance with project QA/QC requirements demonstrating reestablishment of control. The corrective action will be implemented at the lowest level to ensure rapid response. Problems that cannot be resolved at one level will be brought to the attention of the next successive level for action.

Data resulting from a nonconforming action will be reviewed by Ebasco's QA Officer for validity. If data are deemed questionable, action will be taken either to verify the results or to repeat the procedure after the problem is corrected. In no case will invalid data be used or reported.

5.6 Laboratory Turn-around Time

Ebasco will arrange to receive chemical data not more than 30 calendar days after collection of samples except in the case of rapid turnaround samples. Proposed turn-around times are shown in Tables 2-1 through 2-4 of Section 2.0.

5.7 Laboratory Documentation

Ebasco will ensure that all activities associated with sample analyses be documented on hard copy and computer tapes/diskettes as appropriate, including bound notebooks, standard laboratory QA forms, and binders. These forms of documentation will be available for review during laboratory audits.

5.8 Data Reduction, Validation, and Reporting

The equations used in calculating actual sample results are identified in the Laboratory's Quality Assurance Manual previously submitted to the USACE Missouri River Division for laboratory certification.

Data evaluation will be performed by Ebasco's QA Officer Laboratory using EPA functional guidelines. The evaluation of chemical data will include evaluation of blanks, quality control results, and verification of results. Upon completion of data validation, the data will be incorporated into the operation report.

A Daily Quality Control Report (Figure 5-3) will be submitted by the FOL to the USACE Project Manager during field activities which will include a description of all activities, as well as any unusual occurrences or problems.

All of the contractor laboratory data will be included in the operation report. This will include sample results, QC results, a Quality Control Summary Report, and a narrative describing any problems encountered. As it is received, all of the contractor laboratory data will also be sent to the USACE Quality Assurance Laboratory for the completion of the USACE Quality Assurance Report.

Figure 5-3

DAILY QUALITY CONTROL REPORT

Project: **Redstone Arsenal**	Date:
Location:	Weather: Temp: Wind: Humidity:

Personnel:				Field Installations:	
Name	Position	Company	Hours Worked	ID No(s). Drilled: From: To: Footage:	

Equipment:				
Description	Purpose/Use	Time Used	Hours Drilling: Hours Installing: Hours Decon: Hours Development: Hours Sampling: Hours Shut Down:	
			No. of Samples:	
			Type:	

Description of Work Performed:

Health and Safety Levels:

Problems Encountered:

Any Changes From Work Plan:

Remarks:

‿nature:

c:\nancy\rsa\0407

6.0 INVESTIGATIVE DERIVED WASTE (IDW) HANDLING

All discarded materials, waste materials, or other objects will be handled in such a way as to control the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site. All personnel protection equipment materials, (e.g., Tyvek suits, gloves, etc.) will be collected and drummed for appropriate disposal. All waste determined to be hazardous will be removed from the site within 90 days from the time the waste is first placed in its container (i.e., time of generation).

IDW Soil

All cuttings generated from drilling activities will be stored in roll-off boxes placed in areas approved by RSA personnel. The cuttings will be analyzed and characterized, and the roll-off boxes properly labeled and sealed. Contained cuttings will remain onsite until analytical results indicate the presence or absence of contamination. Soil which is determined to be nonhazardous will be placed in the existing Waste Burn Trenches at Unit 2. Nonhazardous wastes will be disposed of only after proper authorization from ADEM. If analytical results indicate that the soil concentrations are above the TCLP maximum criteria, as presented in the code of Federal Regulations, the soil will be classified as hazardous and will be disposed of or treated at an approved hazardous waste facility.

IDW Groundwater

All groundwater generated during this field effort will be temporarily contained on site in 20,000 gallon frac tanks. All water will then be treated onsite by the pilot scale UV/H_2O_2 Oxidation System. Continuous samples of the treated effluent will be collected prior to disposal. Treated water generated during treatability testing will be sampled and recirculated through the system until lab analyses indicate that the water meets NPDES permit discharge requirements. It is proposed to discharge the treated effluent to the nearby surface tributary to the Tennessee River, as shown on Figure 2-1. Ebasco was tasked to prepare an application to modify RSA's existing NPDES Permit to include the proposed discharge point. RSA has submitted this application to ADEM for review and approval.

In the event that the NPDES permit modification is denied or if it is not granted in time, treated water will be transported to the Arsenal's wastewater treatment plant. According to discussions with EPA, up to 25,000 gallons per day of treated water may be discharged to the plant.

IDW Sludge

The pilot scale UV/H_2O_2 Oxidation System will include tanks and filters to flocculate, settle, and remove particles in the groundwater before it is fed to the oxidation chamber. The resulting particles (sludge) will be collected in a 55 gallon drum(s). The sludge will be allowed to settle. Once it has separated, the liquid portion will be decanted and fed to the treatment system, as described above. The remaining bottom sediment will be analyzed for the parameters shown in Table 2-1 and disposed according to the analytical results.

PPE and Miscellaneous Waste

The determination of the hazardous/nonhazardous status of PPE and other waste trash generated during drilling and sampling will be made by evaluating analytical results of the waste soil sampled at the site. If the soil from the site is hazardous, then the PPE or waste trash will be considered to be hazardous and disposed appropriately.

Decontamination Water

Decon water will be funnelled from the decon pad into 55 gallon drum(s). All decon water will then be fed to the onsite treatment system, as described above.

7.0 LIST OF REFERENCES

Ebasco Services Incorporated. Ebasco Field Technical Guidelines.

Ebasco Environmental. Final Work Plan, Interim Corrective Measure Design at Unit 2, Redstone Arsenal, Alabama. February 26, 1993 as revised in April 1993.

Kirk-Othmer. Encyclopedia of Chemical Technology, Third Edition, Volume 9: New York: John Wiley & Sons, Inc. 1978.

U.S. Army Corps of Engineers, Washington, D.C. Chemical Data Quality Management for Hazardous Waste Remedial Activities. ER 1110-1-263. October 1, 1990.

U.S. Army Corps of Engineers, Missouri River Division, Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects Memorandum. August 16, 1989.

U.S. Army Corps of Engineers, Missouri River Division. Installation of Groundwater Monitoring Wells and Exploratory Borings at Hazardous Waste Sites. May 1990.

Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual, February 1, 1991.

U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. March 1983.

U.S. Environmental Protection Agency, Test Methods for Evaluating Solid Waste, SW-846, November 1984.

U.S. Environmental Protection Agency, Guidance for Data Useability in Risk Assessment. October 1990.

APPENDIX A

RESUMES

D. W. SCHAER
Principal Geologist

SUMMARY OF EXPERIENCE (Since 1977)

Total Experience - Fourteen years experience in performing and managing remedial investigations, feasibility studies, site inspections and economic minerals exploration.

Education -	B.S., Geology, MESA State College, 1977 AAS, Civil Engineering Technology, MESA State College, 1975
Courses -	Volcanic Rocks and Their Vent Areas - Mackey School of Mines Tailings Ponds and Their Impoundments, Colorado State University 40 Hour Health and Safety Training for Hazardous Waste Site, 1985 Principals of Groundwater Hydrology, NWWA, 1992
Registrations -	North Carolina No. 236 South Carolina No. 446 Florida No. 495 Tennessee No. 544 Wyoming (in progress)

REPRESENTATIVE EBASCO EXPERIENCE (Since 1987)

Principal Geologist/Hydrogeology Supervisor

Supervises a group of professional geologists/hydrogeologists and chemists. Responsible for job cost control and overhead accounts, in addition to making intragroup decisions.

Technically responsible for design, implementation and managing of remedial investigations for government agencies and industrial facilities. Tasks typically include preparing and implementing work plans for remedial investigations, site inspections and baseline environmental surveys for determining the presence or absence of contaminated soils and water.

Projects Include:

U.S. EPA Region IV - Sangamo Weston Site, Pickens County, South Carolina. Site Manager for an EPA Superfund Project that was designed to assess the effects of PCB contamination at several county landfills. Responsible for planning and managing the overall project and coordinating project activities with the EPA and state officials. This project was completed on schedule with a cost savings of $40K from the budget of $160K.

D. W. SCHAER (Continued)

Georgia Pacific Corporation, Spartanburg, South Carolina. Project Manager responsible for providing client with integrity/inspection of five solid waste management units at GP's container plant to determine the environmental impact caused by each individual SMU. Tasks included providing the client with a report suitable for submission to the EPA documenting the investigations findings. Additional tasks include the removal and thermal treatment of contaminated soils.

U.S. EPA - Tri-City Industrial Disposal Site, Bullitt County, Kentucky. Site Manager for an EPA Superfund RI/FS Project. Responsible for planning and managing both the remedial investigation and the feasibility study for the entire project and coordinating project activities with the EPA and state officials. These responsibilities included assisting the EPA at public meetings with technical responses to concerns voiced by the community.

U.S. EPA - Whitehouse Waste Oil Pits Site, Duval County, Florida. Responsible as Site Manager for planning and investigating bioremediation and solidification/stabilization technologies that could be used in support of a remedial action. A portion of this project included obtaining data sufficient to prepare a risk assessment and providing the EPA with a final risk assessment.

U.S. EPA - Zellwood Groundwater Contamination Site, Orange County, Florida. Responsible as Site Manager for assisting the EPA with a soil solidification/stabilization project. Additional responsibilities included planning, managing and implementing a groundwater monitoring system for monitoring the solidified product and investigating the extent of existing groundwater contamination to support a remedial design for groundwater remediation.

U.S. EPA - Picillo Farm Site, Coventry, Rhode Island. Remedial Investigation Task Leader on a RI/FS project which focused on assessing the areal extent of contamination attributable to six years of illegal bulk dumping of toxic and hazardous wastes. Tasks included developing and coordinating the plans for a field investigation for soils, surface waters, and the groundwater system.

U.S. EPA - Bluff Road Site, Columbia, South Carolina. Project Task Leader on a remedial investigation/feasibility study to assess the environmental impact caused by unregulated disposal of hazardous materials.

Teledyne-Brown Engineering/U.S. Army Missile Command - Redstone Arsenal, Huntsville, Alabama. Technical Lead responsible for the design of a monitoring plan for soils and groundwater to determine any environmental impacts associated with the destruction of Pershing missile motors at two sites in the western United States. Tasks included preparing detailed field plans for State and Federal agencies review.

Georgia Pacific Corporation, Atlanta, Georgia. Project Leader on a baseline environment survey of an existing plant which was being considered for purchase by the client. Tasks included supervision of field sampling, well installation, and preparation of final reports.

D. W. SCHAER (Continued)

PRIOR EXPERIENCE

Versar Inc., Manager of Technical Services. Responsible as technical manager for all remedial investigations and feasibility tasks associated with an EPA technical support contract (TES 7). Duties included providing EPA with independent cost analysis for remedial alternatives identified in feasibility studies generated by primary responsible parties. Additional duties included presenting feasibility studies alternatives, and EPA preferred methods at public meetings.

Project Geologist, Camp Dresser and McKee

Responsible for all aspects of groundwater monitor systems and supervision of field crews conducting remedial investigations. Other responsibilities included project planning and report preparation.

Superfund Projects Include:

Munisport Landfill, North Miami, Florida. Hollingsworth Solderless Terminal, Fort Lauderdale, Florida; Mowbray Engineering Company, Greenville, Alabama (Celanese-Shelby Fiber Operations), Shelby, North Carolina; Coleman-Evans Wood Preserving Company, Whitehouse, Florida; Newsom Brothers/Old Reichold, Columbia, Mississippi; Bypass 601 Groundwater Contamination, Concord, North Carolina; Hipps Road Landfill, Duval County, Florida; Maxey Flats Nuclear Disposal, Hillsboro, Kentucky and Perdido Groundwater Contamination, Perdido, Alabama.

Oak Ridge National Laboratory, Geologist. Team leader responsible for planning and conducting filed radiological surveys to investigate potential hazardous radioactive contamination. Prepared final reports from field-generated data for the Department of Energy's uranium mill tailings removal act.

Bendix Field Engineering Corporation, Staff Geologist. Project Geologist for remedial action programs dealing with the study of radioactive tailing piles. Duties included interpretation, sampling of tailings and installation of monitor wells. Also, as part the Bendix Exploration staff, conducted exploration drilling programs in the western United States. Planned and supervised the completion of, and lithologically logged, 54,000 feet of rotary and core test holes. Conducted comprehensive geochemical, geophysical, and reconnaissance mapping surveys as part of grass roots exploration programs in the Basin and Range Province of Nevada, California, and southeastern Utah.

Idaho Mining Company, Exploration Geologist. Conducted drilling programs in Colorado and Utah for mining exploration and development. Planned, supervised, and provided lithological and geophysical logging of more than 300 rotary test holes.

D. W. SCHAER (Continued)

SELECTED PUBLICATIONS

Publications

Schaer, D. W., 1981. A Geological Summary of the Owens Valley Drilling Project, U. S. Department of Energy, Open File Report GJBX-128(81).

Schaer, D. W., 1984. Monticello Remedial Action Project Site Analysis Report, Geological Investigation Section, U. S. Department of Energy, Open File Report GJ10.

Morrison, Schaer, Daniels, 1984. Minerals Evaluation of a Denied Area, Classified Document.

KIMBERLY SOOVAJIAN VEAL
Environmental Engineer

SUMMARY OF EXPERIENCE

Ms. Veal has over four years of engineering and management experience in applications related to environmental compliance of solid and hazardous waste projects, including regulatory and licensing activities for the government and private sector. Her responsibilities include Preliminary Assessments under CERCLA, Remedial Investigations under DERP, Contamination Assessments, preparing Environmental Impact Statements, Environmental Resource Documents, RCRA Part A and Part B Permit Applications, Work Plans and Engineering Reports.

Education: B.S., Civil Engineering, 1988

Registrations: E.I.T./1988/New York
Medically monitored and 40-Hr. Health and Safety Trained

REPRESENTATIVE EBASCO EXPERIENCE

U.S. Army Corps of Engineers, Savannah District - Task Manager of four projects which involve the design of interim corrective measures to remove, treat, and dispose of groundwater contaminated with volatiles, semi-volatiles, BNAs, pesticides, and metals. The projects involve the preparation of work plans, design drawings and specifications plans, various installation and operation plans, construction and operation scheduling and cost estimating, and community relations.

City of Atlanta - Site Manager of the Hemphill Project Site. Developed a scope of work for the City to assess the level of soil and groundwater contamination near a water supply reservoir, including TCE, PCE, TCA, and aromatic hydrocarbons. She is providing overall project management of the effort which includes field sampling and preparation of engineering reports.

U.S. Army Corps of Engineers, Mobile District - Prepared environmental assessment for the Base Realignment and Closure (BRAC) action at Anniston Army Depot.

U.S. Army Corps of Engineers, Huntsville Division - Site Manager and Site Health and Safety Officer for DERP FUDS project area suspected of chemical ordnance contamination. She conducted an archives search to determine the potential for UXO/EOD contamination and prepared the work plans for remediation of the contaminated areas. She prepared a detailed report of findings and recommendations, including a risk assessment for each site.

U.S. Army Corps of Engineers, Mobile District - Prepared a classified (DOD-secret) environmental assessment for the storage and demilitarization of nuclear weapons.

U.S. Army Corps of Engineers, Huntsville Division: Preparation of environmental assessment pertaining to interim remedial treatment of fuel contaminated soil and ground water at Defense Fuel Supply Point, Ozol, CA.

U.S. Army Corps of Engineers, Huntsville Division: Preparation of RCRA Part A and Part B permit applications for munitions deactivation furnaces at seven Army installations.

NASA, Marshall Space Flight Center: Determination of environmental baseline conditions at the entire facility and subsequent preparation of an environmental resource document.

The University of Alabama in Huntsville and U.S. Army MICOM: Preparation of supplemental environmental assessment for the addition of an Aero-Optics laboratory and photographic laboratory to the Aerophysics Test Facility on Redstone Arsenal, AL.

As an Environmental Engineer with Stone & Webster Engineering, Boston, MA, Ms. Veal managed preparation of environmental reports for the Federal Energy Commission and NY Public Service Commission and was responsible for permitting on federal, state and local levels of over 200 miles of pipeline in northeast U.S. She has been primarily responsible for the environmental impact assessments of large scale engineering and utility projects on water quality, ecological resources, topography, and other environmental resources.

Ms. Veal was assigned as an Environmental Inspector of construction and has participated in and testified at numerous public hearings.

Experience in Waste Management includes: Assisting in the development of Environmental Impact Statement for the ongoing New York City Sludge Management Project; siting studies for long-term sludge disposal; site assessments to identify potential hazardous waste sources at candidate construction site, and review of state-of-the-art and proven sludge processing and disposal technologies applying various site/technology constraints.

As an Engineering Aide for New York State Electric and Gas, Binghampton, NY, Ms. Veal designed weir to mitigate thermal plume effects of power plant cooling water discharge to meet NPDES permit requirements; coordinated contractors and vendors, prepared bid package and conducted prebid meeting site visits; and prepared numerous cost estimates and wrote technical specifications.

While employed with Broome County DPW Engineering Division; Binghampton, NY, she developed division's first computer-based engineering support system; produced computer-aided drawings of preliminary engineering projects; developed macros to complement existing software; and maintained traffic accident location maps.

BRUCE A. RAABE, P.G.
Geologist

SUMMARY OF EXPERIENCE

Total Experience - Mr. Raabe has 17 years of experience as a certified professional geologist including geological research, subsurface mapping, field investigations, hydrogeology, drilling, well design, installation and development, monitoring and sampling, geophysical logging, seismic interpretation, groundwater remediation and system installation geochemical, soils investigation and project management. He is currently a Senior Geologist responsible for task management and field operations of environmental projects related to EEC operations at the DOE Savannah River Site (SRS). His responsibilities also include engineering and geologic support of groundwater investigation; soil investigation, subsurface characterization, compliance assessment and permitting projects.

Education -
M.S./1983/Geology
B.S./1975/Geology
OSHA 40-Hour Hazardous Waste Operations
Radiation Worker Training (**SRS**), 1993
Environmental Laws & Regulations, 1992
Toxicology, 1992
Air Dispersion Modeling (1992)
Expert Witness in Alabama, Oklahoma and Texas

Registrations -
National Ground Water Association
American Institute of Professional Geologists (Certified)
American Association of Petroleum Geologists (Certified)
Professional Geologist - WY, TN, (KY, SC, GA pending)

REPRESENTATIVE ENSERCH ENVIRONMENTAL EXPERIENCE

Provided engineering support and field oversight for recovery well redevelopment and development of a Recovery Well Cycling Program Plan for the A/M Area Groundwater Remediation Program.

Provided engineering field oversight and task management of a kaolin clay boring and sampling program at two commercial clay mines. Laboratory soil testing and analysis for specific geotechnical physical properties was used as a clay liner selection criteria.

Served as technical lead and provided field oversight on cone penetrometer testing projects in the A/M and F/H Areas. Collected geophysical log data as well as soil and groundwater samples used to correlate lithologic units and delineate the plume extent and degree of contamination at each site. Results of the field studies provided data on aqueous phase-soil sorption coefficients of heavy metals, radionuclides and DNAPLs.

BRUCE A. RAABE, P.G. (Continued)

Performed characterization analysis of reservoirs using porosity, permeability, fluid contact, pressure and pump test data as well as mapping geologic formations and fluid distributions utilizing cross-sections, drill samples and borehole logs.

Co-generated and managed a major geologic/geophysical investigation that defined various salt domes and their potential use as hazardous waste disposal sites as well as natural gas storage reservoirs. Responsible for all phases of technical report writing and editing as a means of total team quality control.

Oversight of field activities and site characterization on more than 90 wells resulting in efficient and cost effective operations.

Pioneered initial company-wide use of geochemical soil sampling techniques for subsurface hydrocarbon detection on four uniquely different projects.

Computer literate in economic (Monte Carlo), groundwater and air dispersion modeling (EPA-SCREEN and ISCST models) as well as MS-DOS, WordPerfect, and Lotus.

PRIOR EXPERIENCE

Applied Earth Science, Inc. - Mr. Raabe performed multi-site UST investigations for a major petroleum company. He was involved with the full spectrum from initial site assessment to drilling delineation and remediation using VES, air sparging and pump-and-treat technology. He was also responsible for all phases of report generation and presentation. His experience in this position made him proficient in hollow-steam auguring, continuous and split spoon sampling, organic vapor monitoring using PID and FID equipment, slug and specific capacity tests and sampling and monitoring protocol.

JOHN A. WALKER
Chemist/Health & Safety Coordinator

SUMMARY OF EXPERIENCE

Over five years experience in data analysis, chemical and physical laboratory testing, field investigations, and health and safety coordination.

Education - BS, Biology/Chemistry, Oakwood College, 1986
40-Hour OSHA Remedial Response Health & Safety Training Course
Industrial Pretreatment Course
American Red Cross, First Aid/CPR Certification
16 Hours OSHA Specialized Supervisory Health & Safety Training
Removal Cost Management System, EPA
Hazardous Waste Site Sampling, EPA
Fundamentals of Industrial Hygiene Course
Comprehensive Industrial Hygiene Review

Affiliations - Georgia State Board of Examiners for Certification of Laboratory Analysts - #011049

REPRESENTATIVE EBASCO EXPERIENCE (Since 1990)

Responsible for coordinating all health and safety training of personnel in the assigned region, keeping records of training, ensuring that all field personnel's training is kept up to date and current, establishing a medical surveillance program for the assigned region, ensuring scheduling of all employees' physical examinations, and maintaining a file of all personnel within the assigned region. Other duties include implementing and developing health and safety, accident prevention and emergency response plans; conducting and reviewing audits; designating health and safety officers; implementing respiratory protection programs, hearing protection programs, and excavation programs. Other responsibilities are sample coordination with various laboratories which include consultation with site personnel on sample planning and analysis protocols. Other duties include site assessments, field investigations, and data validation.

Projects Include:

Environmental Protection Agency - SCRDI/Dixiana, South Carolina Superfund Sites (ARCS IV Program). Responsible for Comprehensive Field Sampling Program which included sampling contaminated groundwater from monitoring well, influent and exfluent, associated with a 20-well groundwater extraction and treatment system. Additional responsibilities included general inspection of treatment plant to ensure proper functioning. Coordination with subcontractor in correcting site problems and implementation of a comprehensive sample tracking system.

Georgia Department of Natural Resources - Georgia Underground Storage Tank (GUST) Trust Fund Projects. Served as Health and Safety Coordinator and provided field support on several GUST site investigations conducted throughout Georgia. GUST site investigation activities included the installation of monitoring wells, subsurface soil sampling, and groundwater sampling to underground storage tanks.

U.S. Department of Energy (DOE). Provided contractor and health and safety oversight during cone penetration monitoring.

Fort Gordon, Augusta, Georgia. Provided contractor oversight and health and safety coordination for the Army Corp of Engineers (ACOE) during monitoring well installation, drilling, and sampling at the various on-site locations. Subsurface soil and groundwater sampling were conducted to determine the presence and extent of potential contamination from on-site underground storage tanks.

Fort Jackson, Columbia, South Carolina, Groundwater Remediation. Provided contractor oversight and health and safety coordination for the ACOE during monitoring well installation, drilling, and sampling at the various on-site locations. Subsurface soil and groundwater sampling were conducted to determine the presence and extent of potential contamination from on-site underground storage tanks.

Laurinburg Maxton Airbase, Laurinburg, North Carolina. Provided contractor oversight and health and safety coordination for the ACOE during monitoring well installation, drilling and sampling at four landfills located at both air bases. Other duties included developing and implementing of HASPs and other planning documents.

New Hanover International Airbase, Wilmington, North Carolina. Provided contractor oversight and health and safety coordination for the ACOE during monitoring well installation, drilling and sampling at four landfills located at both air bases. Other duties included developing and implementing of HASPs and other planning documents.

Army Corps of Engineer (ACOE), Environmental Compliance Assessment Systems (ECAS). Participated as a member of 20 teams responsible for ensuring environmental compliance with state and federal regulation for the Alabama Army National Guard (ARNG).

Longhorn Army Ammunition Depot, Pershing Rocket Motor Static Firing. Duties included sampling depositions from the static firing of Pershing P1 rocket motors at the Longhorn Army Ammunition Depot using a modified version of the Standard Method for Collection and Analysis of Dustfall (Settleable Particles) (ASTM D1739-70). In addition to deposition samples, ambient air samples were collected for PM_{10} and ambient air HCl concentrations during plume passage. In conjunction with sampling, health and safety oversight was provided.

Martin Marietta Uranium Enrichment Plant/Gerthy Miller. Provided contractor oversight and health and safety monitoring during drilling, well installation, developing and sampling of monitoring well at approximately 300 on-site locations. Subsurface and ground water sampling were conducted to determine the presence and extent of TCE contamination from on-site lagoons.

City of Atlanta Underground Storage Tank (UST) Removal. Provided contractor oversight during the removal of USTs and the excavation of contaminated soil/debris from on-site locations. Subsurface soil sampling were conducted to determine the presence and extent of potential contamination from on-site USTs. In conjunction with contractor oversight, health and safety oversight was provided.

Gwinnett County Underground Storage Tanks. Provided contractor oversight and health and safety monitoring during monitoring well installation, drilling, and sampling at the various Gwinnett County fueling locations. Also monitored subcontractors during the Petro-Tite tank testing prior to well installation. Subsurface soil and groundwater sampling were conducted to determine the presence and extent of potential contamination from on-site underground storage tanks.

U.S. EPA ARCS IV and REM III, Wrigley Charcoal Plant, Geiger (C&M Oil) Site, Tri-City Disposal Site. Participated in developing the Remedial Investigation reports. Duties included technical writing, preparing spreadsheets (tables and figures) on analytical results utilizing Lotus 123/Allways, and preparing risk assessments.

U.S. EPA REM III - Independent Nail and Galloway Pond. Developed a technical summary evaluating the analytical results for third and fourth quarter operations and maintenance sample activity for the various sites.

PRIOR RELEVANT EXPERIENCE (3 Years)

Roy F. Weston, Inc. Atlanta, Georgia, 1989 - 1990. Worked under the Technical Assistance Team contract for the emergency response branch of Region IV U.S. EPA. Responsible for providing technical assistance to EPA On-Scene Coordinators in emergency response and removal actions. These tasks included researching and developing treatment and disposal options, bench-scale testing of treatment processes, investigating hazardous materials and oil spills, and cost monitoring of cleanup contractors. Also responsible for generating technical reports to the agency on which enforcement actions were based.
Carolina Chemical, Columbia, South Carolina. Served as Technical Assistance Team Leader (TATL) for the emergency response cleanup of all hazardous wastes located on-site. Duties included monitoring subcontractors; monitoring subcontractors cost (Removal Cost Management Systems); Health and Safety Officer (HSO), and sampling and overseeing excavation. Worked closely with all parties involved in the cleanup and provided interface

between the cleanup contractor and the On-Scene Coordinator (OSC) during all phases of the contract.

Chemical Removal Phase II (PRP Removal), Brunswick, Georgia. Served as TATL for the emergency response cleanup of all hazardous wastes located onsite. Duties included HSO, monitoring and documenting the responsible party cleanup and the verification of sampling. Worked closely with all parties involved in the cleanup and provided interface between the cleanup contractor and the OSC during all phases of the contract.

Slater Plant, Slater, North Carolina. Participated in the field investigation. Duties included HSO, Geophysical survey and subsequent sampling utilizing the EM-31. Results of the survey pinpointed geophysical anomalies.

Cahaba Wood Preserving, Suttle/Sprott, Alabama. Served as Field Investigation Leader for the sampling, file searching, and geophysical surveying investigation necessary to characterize site conditions and contaminants. Responsible for health and safety and for the supervision of technical staff during investigation.

Fulton County Public Works, Atlanta, Georgia; 1987 - 1989. As an environmental analyst, Mr. Walker conducted tests and field investigations to obtain data for use by environmental, engineering and scientific personnel for the determination of sources and methods of controlling pollutants in water, soil and sludges. Utilized chemistry and engineering principles to determine characteristics of solid or liquid materials and substances applying the use of pH meters, chemicals, autoclaves, microscopes, centrifuges, spectrophotometers, analytical instrumentation (AA, GC, TOC) and chemical laboratory equipment. Installed, operated and performed routine maintenance on mechanical equipment and other test instrumentation.

GERALD L. DELANEY
CIH Supervising Engineer

SUMMARY OF EXPERIENCE

Mr. Delaney has over 25 years of progressively responsible experience in safety, industrial hygiene, environmental engineering and project management for hazardous and toxic waste and environmental programs. He provided program oversight for the Department of the Army in both the occupational health and environmental health arenas.

Education: MS/1966/Environmental Engineering
BCE/1964/Civil Engineering

Registrations: 1980/Certified Industrial Hygienist

REPRESENTATIVE EBASCO EXPERIENCE

As Industrial Hygiene Consultant to the Army Surgeon General, LTC Delaney provided oversight of the Army's industrial hygiene program worldwide. As Director for Industrial Hygiene at the U.S. Army Environmental Hygiene Agency (USAEHA) Col Delaney managed a worldwide industrial hygiene support program which supported DERP, IRP, and the Kuwait Oil Fire Health Risk assessment.

As Director for Environmental Quality/Environmental Health Engineering at the U.S. Army Environmental Hygiene Agency, Col Delaney managed oversight of USAEHA support of the Army's DERP, IRP and all hazardous waste projects worldwide. He oversaw the USAEHA and the Agency for Toxic Substances and Disease Registry (ATSDR) interface on all hazardous waste projects/sites which the ATSDR evaluated. He developed and presented the 8-Hour annual OSHA update to employees requiring annual recertification within the Hazardous Waste Division at the USAEHA.

As Commander, U.S. Army Pacific Environmental Health Engineering Agency, Sagami, Japan, he directed studies and laboratory services in environmental health, environmental pollution, environmental sanitation, industrial hygiene, medical entomology, radiological health, and toxic and hazardous waste disposal, for all U.S. Army and selected DoD installations in the western pacific area of operations.

As Project Officer at U.S. Army Medical Laboratory, Ft. Baker, CA, he conducted radiation protection surveys and industrial hygiene surveys at U.S. Army facilities throughout the western United States and Alaska.

As Industrial Hygienist at USAEHA, he conducted comprehensive industrial hygiene studies at U.S. Army facilities worldwide.

DIANE MORRELL, C.I.H.
Risk Management Specialist

SUMMARY OF EXPERIENCE

Ms. Morrell has more than 10 years of professional experience in the recognition, evaluation, and control of hazardous materials in industrial settings. She has extensive experience in various aspects of occupational safety and health, risk assessment, air monitoring to assess airborne contaminant hazards, selection of appropriate engineering and/or administrative controls, and specification of appropriate personal protective equipment.

Education - B.S., Environmental Health, Colorado State University, 1980

Registrations - Certified Industrial Hygienist, 1987
DOE Q Clearance, 1991

REPRESENTATIVE EBASCO EXPERIENCE

Ms. Morrell serves as manager of the interim response action risk assessments for the Rocky Mountain Arsenal (RMA). This ongoing project involves calculating risks to workers and the public from proposed interim response actions at RMA. This procedure uses Environmental Protection Agency risk assessment methodology and defines exposure pathways, affected populations, and calculations of contaminant intake rates and risks to workers and the public. Each risk assessment requires a separate comprehensive report.

Ms. Morrell is the task manager for the surficial soils exposure assessment at RMA. This involves exposure pathways analysis of surficial soil contaminant results for exposure exceedances to different populations in a variety of land uses. This information will be used in a risk characterization and will provide information for the feasibility study.

Ms. Morrell has serviced three RMA projects: the Basin F Interim Action, remedial investigation/feasibility studies (RI/FS) and the Comprehensive Monitoring Program (CMP). The Basin F Interim Action was a cleanup operation that involved intensive personnel training, a medical surveillance program, high degrees of personal protective equipment use (up to 100 employees in Level B), complex air monitoring programs for personnel, and ambient air monitoring. This project had a safety-related staff of up to 25 people to ensure safety and health through the entire project. The RI/FS and CMP programs are environmental study programs in which sampling of potentially contaminated contaminated materials is performed, and Ms. Morrell oversees a staff of four to six individuals who provide industrial hygiene and safety support to these projects.

Ms. Morrell is a work element manager for the Warren Air Force Base Draft Exposure Assessments. Her duties are to oversee the work efforts and provide guidance to staff in the selection of contaminants of concern, database verification, characterization of potentially exposed populations, developing exposure pathway scenarios, and calculation of contaminant intake rates from the identified exposure pathways. These exposure assessments are being conducted for several different operable units at the Air Force Base including sitewide groundwater.

Ms. Morrell is involved in conducting baseline chemical, physical, ergonomic, and biological hazard assessments for various tank farms at DOE's Hanford Reservation. This project includes walkaround inspections to identify potential hazards and industrial hygiene sampling and monitoring to validate baseline hazard assessments. Additionally, the scope of work includes the development of an industrial hygiene assessment program plan to identify the ongoing industrial hygiene needs of the tank farms and the development of a schedule for completion of hazard assessments in the remaining tank farms.

Ms. Morrell is currently the Health and Safety Director for EBASCO. Her responsibilities include developing corporate safety policies and procedures, ensuring the implementation of site-specific the Health and Safety Plans (HASPs), developing and updating HASPs, ensuring selection and utilization of appropriate personal protective equipment, coordinating all safety and health activities in regard to hazardous materials, and delegating duties to the health and safety staff in the field.

Ms. Morrell participated in the safety analysis of a waste handling process design at the Idaho National Engineering Laboratory. This project involved analyzing process design drawings and descriptions to develop accident scenario incidents and to estimate the likelihood of their occurrence. This required an in-depth analysis of the proposed process to determine all possible accidents that may occur, including contaminant release from container breeches, fire/explosion scenarios, and occupational safety accidents.

Ms. Morrell was responsible for evaluations and recommendations on the management of hazardous materials, including occupational and environmental concerns, for the Sister of Providence Corporation, Environmental Impairment Liability Assessment Program at its acute care facilities (hospitals).

Ms. Morrell has provided industrial hygiene consulting services to Mobil Oil Corporation and Marathon Oil Company. She performed personnel monitoring for a variety of chemical compounds, evaluated analytical results, and made recommendations for personal protective equipment, medical surveillance, and engineering controls.

Ms. Morrell prepared a HASP for the Eagle River Hazardous Waste Collection Facility, Municipality of Metropolitan Anchorage, for Northwest Enviroservice, Inc. This was a comprehensive HASP designed to provide guidance for employee protection for a collection, storage, and shipment facility for hazardous household chemical wastes and chemical waste from small quantity generators.

Ms. Morrell was involved in the preparation of an environmental assessment for the Picatinny Arsenal EMP Facility where she performed the occupational and public risk evaluation. This facility is a non-ionizing radiation source used to test equipment and machinery for adverse effects in the electric and magnetic fields potentially generated from a nuclear explosion.

Her other project experience includes coordination, technical expertise, and litigation support in evaluating asbestos removal for the Antranik Barsamiam Project; performing air monitoring, evaluating sample results, and making recommendations to correct the exposures for airborne solvent exposures at Computer Sciences Corporation; performing soil sampling and making recommendations for appropriate health and safety protocol for the Stockton Plating Project.

Ms. Morrell's other responsibilities as the health and safety manager include developing and implementing health and safety training courses for employees and subcontractors to work at hazardous waste sites; implementing a medical surveillance program for the region; approving designated site health and safety supervisors; approving site-specific HASPs; and establishing and maintaining permanent record-keeping systems for medical examinations, field work, employee training, project records, and other related areas.

PRIOR EXPERIENCE

U.S. Department of Labor,
Occupational Safety and Health Administration
Industrial Hygienist (7 years)

Ms. Morrell performed numerous industrial hygiene investigations for a large variety of industrial settings. Her work duties entailed recognizing potential chemical and/or physical hazards; monitoring to assess hazards; evaluating monitoring data; and recommending appropriate engineering and administrative controls, as well as appropriate personal protective equipment relative to the hazard. Investigations were also performed for fatalities and catastrophic occurrences. She also provided support and testimony for litigation. Her experience also included evaluating asbestos abatement operations in the demolition or removal of pipes, structures, or equipment covered or insulated with asbestos. The evaluation consisted of recognition of potential asbestos-containing materials in buildings, assessment of potential exposures from the asbestos-containing materials and the feasible abatement methods, assessment air monitoring programs and personal protective equipment, and knowledge of federal regulations regarding asbestos in buildings. Litigation support and testimony were also provided for these evaluations.

Ms. Morrell also attended the EPA "Hazardous Materials Incident Response Operations Course" and was a designated team member for hazardous materials investigation and response for Region VIII.

ASHTON C. PEARSON
QA/QC Manager

SUMMARY OF EXPERIENCE

Mr. Pearson is a degreed Mechanical Engineer with over 14 years of quality-related experience, more than 12 years of which have been in nuclear power plant construction and operation. Areas of expertise include quality program management, procurement quality activities related to vendor evaluations, source surveillance, and procurement document reviews. Balance of expertise involves design-related activities in the manufacturing and chemical industries.

Education -	B.S., Mechanical Engineering, 1977, University of Mississippi
Courses -	OSHA 40-Hr. Hazardous Waste Operations DOE Q Clearance Certified Lead Auditor

REPRESENTATIVE EBASCO EXPERIENCE

Assigned as a member of the Environmental Restoration Waste Management (ERWM) Program team. Responsibilities include ensuring that all activities affecting quality within Ebasco meet the requirements of the DOE-approved ERWM Quality Assurance Plan (QAP). The ERWM QAP govern work at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. Compliance with the QAP is verified by performing audits and surveillances of discipline activities.

Assigned to the on-site Quality Assurance (QA) group. In this position, responsible for ensuring that quality-related activities within Ebasco meet the requirements of the TVA-approved Ebasco Nuclear Quality Assurance Program. Additionally, performed scheduled and unscheduled surveillances and audits of discipline activities.

PRIOR EXPERIENCE

Florida Power & Light Company - Assigned to the Nuclear Energy Department, Quality Assurance Procurement and Reliability Group, in support of St. Lucie Nuclear Plant, Units 1 and 2, Jensen Beach, Florida; and Turkey Point Nuclear Plant, Units 3 and 4, Florida City, Florida. In this position, assisted in the overall development of policies and methods, and directed the preparation, development, and implementation of operating procedures that affected safety-related functions. Additionally, utilized Statistical Process Control (SPC) techniques to collect data from information systems and computer programs to plan, implement, administer program of supplier quality audits and source surveillances, and to analyze supplier data to identify recurring problems. Also, responsible for personnel selection, supervision, and guidance of Florida Power & Light Quality Assurance Engineers and various contractor companies that performed safety-related services to support the operation of four nuclear power plants.

ASHTON C. PEARSON (Continued)

Mississippi Power and Light Company - Assigned as Quality Assurance Engineer Supervisor - Vendor Activities, in support of Grand Gulf Nuclear Station, Port Gibson, Mississippi. In this position, assisted the manager in development of policies and methods; directed the preparation and implementation of operating procedures and policies; planned, implemented, and administered program of supplier quality audits/surveys. Analyzed supplier data to identify recurring problems and to initiate corrective action; coordinated system for supplier quality programs evaluation activities and procurement document review; and was responsible for personnel selection, supervision, and guidance of Quality Assurance Engineers. Additionally, conducted internal and external Quality Assurance Audits.

General Cable Corporation - Responsibilities included the implementation and coordination of various plant projects, including new product design; prepared technical reports, supervised Quality Control personnel, and developed QA/QC standards relative to manufacturing CATV cable.

PPG Industries - Responsibilities included the development, review, and coordination of engineering maintenance work orders and providing project design. Additionally, responsible for the daily operation of the PPD chemical plant in Lake Charles associated with utility/power generating department activities.

S. K. JONES, REPA
Environmental Chemist

SUMMARY OF EXPERIENCE (Since 1979)

Total experience - Work experience consists of thirteen years of environmental chemistry experience. This background covers hands-on laboratory analyses of a wide variety of environmental and industrial samples and supervisory level management of laboratory activities.

Education - B.S., Villa Maria College, 1979 - Biology/Chemistry

Member - American Chemical Society, National Registry of Environmental Professionals

Courses - 40 Hour Health and Safety Training for Hazardous Waste Site, 1988
REM III Supervisory Training, 1989
8 Hour Health and Safety Refresher, 1990
Numerous Hazardous Waste Seminars and Conferences

REPRESENTATIVE EBASCO PROJECT EXPERIENCE (Since 1988)

Environmental Chemist

Ms. Jones performs as Technical Lead on many hazardous waste and environmental projects. This involves writing and reviewing FSAPs, QAPPs, subcontractor laboratory bid specifications, and other technical documents. Also consults with Project Managers regarding sampling and analysis protocols. Coordinates all non-CLP laboratory analysis.

REM III Program. Coordinated all laboratory support services provided by the REM team members. The analytical level of support for this project was in excess of 3 million dollars in lab fees over a 4 year period. Performed audits on mobile laboratory operations at Superfund sites.

EPA Regions I, III, and V. Data validation experience for Regions I and III consists of more than 400 hours of Contract Laboratory Program (CLP) protocol validation. Designed mobile lab specifications for the ARCS V program which was chosen out of three as the prototype lab trailer for the Region.

S. K. JONES (Continued)

State of Georgia and Gwinnett County. Serves as laboratory liaison for the Underground Storage Tank (UST) programs for these two clients. This involves writing technical specifications for all laboratory activities and analyzing reported results. Writes Health and Safety Plans for field activities and serves as Health and Safety Officer for these sites. Performs well searches as part of Corrective Action Plans.

Army Corps of Engineers. Is Technical Lead for ongoing UST and hazardous waste sites that involves compiling all analytical data, evaluating it for usability, and writing Chemical Data Acquisition Plans, Work Plans, and Engineering Reports. Five sites are currently in progress in this program. Was Technical Lead on Part B Permit Applications at 20 sites across the country and developed waste characterization and analysis plans for these sites. These sites involved open burning and/or open detonation of waste munitions. Also prepared Part B Permit Applications for the United States Military Academy at West Point, Crane Army Ammunition Activity, and the NASA facility at Wallops Island.

FPL. Developed a Hazardous Waste/Materials Minimization Plan which included creating a database of all hazardous materials presently used or in design specifications and utilizing a hazard ranking system to prioritize minimization efforts.

Penelec. Developed contractor bid specifications for all environmental aspects of demolition of a coal-fired power plant. The environmental concerns included asbestos, fly-ash, and PCBs.

United States Postal Service and Various Clients. Has performed real-estate transfer audits to comply with various environmental regulatory and internal requirements.

Prior Experience (8 years)

Metallurgical Engineers, Div. of ATEC Associates (1987)

Ms. Jones was engaged to re-initiate activities of the chemistry laboratory at this division. She was responsible for planning and design of the laboratory and for all instrument and equipment maintenance and performance. She was also responsible for the hiring, training, and supervision of laboratory technicians.

S. K. JONES (Continued)

One of Ms. Jones' principal tasks was to obtain certification of the laboratory by the American Association of Laboratory Accreditation and the State of Florida. To accomplish this, she composed and implemented a Quality Assurance/Quality Control Manual that was used by all three divisions of the Company, and successfully completed on-site evaluations by both agencies as well as analyses of performance evaluation samples. Ms. Jones was responsible for tracking all quality control activities and summarizing the information in graphs and charts.

Dunn Laboratories (1980-1987)

Ms. Jones obtained extensive background in the analysis of environmental and industrial samples. Because of the variety of the work load, Ms. Jones was called upon to develop new methods or modify existing methods.

Ms. Jones regularly performed laboratory analyses of potable water using EPA-approved methodology. She also analyzed wastewater for its conformance to N.P.D.E.S. permitting limitations and assisted clients in completing permit applications and reporting. Ms. Jones has extensive experience in the analysis of solid waste for the determination of its hazardous characteristics, such as ignitability, corrosivity, reactivity, and E P Toxicity metals using the methods in SW-846. This testing was done for some clients as part of delisting petitions or for informational purposes prior to disposal. Ms. Jones also analyzed debris obtained from fire and/or explosion scenes to determine presence of accelerants.

REDSTONE ARSENAL UNIT 2
DRAFT FIELD SAMPLING AND ANALYSIS PLAN (FSAP)
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: BILL SARGENT
DATE: 26 APRIL 1994

- *Comments from Bill Sargent*

  We have reviewed the Draft Field Sampling and Analysis Plan for Test Well Installation at Unit2, Redstone Arsenal. There are no comments.

  Ebasco Response

  Comment acknowledged.

REDSTONE ARSENAL UNIT 2
SITE SAFETY AND HEALTH PLAN (SSHP)
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: ISMAEL PEREZ/VIVIAN GREEN
DATE: 15 APRIL 1994

- *Item No. 1*

  Comment

  The subject SSHP was reviewed and found to be acceptable with the following comments.

  a. *Page 12-3, Hospital Routes. All roads to the hospitals are not included on this map, specifically McAlpine Road. Also, indicator arrows on the map would aid in identification of the routes.*

  b. *A certified listing of the type of training, duration, and dates of employee training listed by name is required to be included in this SSHP.*

  c. *A certification of participation in the medical surveillance program, the date of the last examination, and the name of the reviewing occupational physician for each affected employee is required to be included in this SSHP.*

  d. *A certified Industrial Hygienist is required to sign and date the final SSHP.*

  Ebasco Response

  a. Figure 12-1 has been revised.

  b. Health and Safety training certificates for Ebasco personnel currently authorized to perform work on-site are now included in Appendix F. Certificates for subcontractor personnel will be available on-site upon mobilization.

  c. Medical surveillance certifications for Ebasco personnel currently authorized to perform work on-site are now included in Appendix F. Certification for subcontractor personnel will be available on-site upon mobilization.

  d. The final SSHP will be signed by a C.I.H.

- *Item No. 2*

  Comment

  POC is Vivian Green, Industrial Hygienist, x5007.

  Ebasco Response

  Comment acknowledged.

REDSTONE ARSENAL UNIT 2
REVISED FINAL WORK PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: BILL SCHRODER
DATE: 13 APRIL 1994

- *Item No. 1, Cover*

  Comment

  Does not meet EPA's standards. Leave off Contract #, COE Insignia and Ebasco stuff.

  Ebasco Response

  Cover has been revised.

- *Item No. 2*

  Comment

  See Tim Browns Comments 1 thru 4.

  Ebasco Response

  Comment acknowledged.

- *Item No. 3, Page No. 2-6, Para. 2.1.2.c*

  Comment

  Should be "Open Burn Pads" not OB/OD Area. This is a no-no from now on! Make changes through this and future literature please.

  Ebasco Response

  The change has and will be made.

- *Item No. 4, Page 2-10, Para. 2.2.1.g*

  Comment

  Is Savannah District going to consider the 2 phase vapor extraction treatment system in these options? If so, we need to present it here.

  Ebasco Response

  This comment has been deferred to the Savannah District for response.

- *Item No. 5, Page 3-1, Para. 3.1.1.a*

  Comment

  UGH - This is the 3rd or 4th time I've read this universal statement. It is necessary?

  Ebasco Response

  In our meeting with EPA regarding the Unit 1 Work Plan, EPA requested repetitiveness of the need for additional field work.

REDSTONE ARSENAL UNIT 2
REVISED FINAL WORK PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: TIM BROWN
DATE: 12 APRIL 1994

- *Item No. 1, Cover Page*

  Comment

  Take off mention of RSA-12 and 131 as these are not DERA eligable.

  Ebasco Response

  RSA-12 and 131 have been removed, except to describe them as being located at Unit 2.

- *Item No. 2, Page 1-3, Para. 1.1.2*

  Comment

  Describe specifically - (1) Burn Trenches, (2) Pop and Burn, (3) Rocket wash out ------ as being the sites targeted for cleanup. Also (4) Open Burn Pad's.

  Ebasco Response

  Paragraph 2.1.2.a has been revised as such.

- *Item No. 3, Page 2-1b, Para. 2.1.b*

  Comment

  RSA-61? Is this correct number? Should be RS-061?

  Ebasco Response

  The correct designation is "Well RS 361".

- *Item No. 4, Page 2-14, Para. 2.5.a*

  Comment

  Must consider protection of pipe (especially flexible pipe) from mowers and other heavy equipment used in area. Also, should we consider blast protection? I do not recommend anything except steel pipe for the final ICM. It should also be painted a noticeable color to keep mowers off. A good idea would be to lay the pipe on existing ground and cover with enough dirt that mowers would not have to avoid.

  Ebasco Response

  The piping will be elevated on pipe supports. Rigid piping will most likely be used in lieu of flexible piping and will be brightly painted, as requested. These elements will be presented in the 90% Design submittal.

REDSTONE ARSENAL UNIT 2
REVISED WORK PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: FRED MOSER
DATE: 06 APRIL 1994

- *Item No. 1, Section 2.2.b, Page 2-7*

  Comment

  The next to the last sentence in this paragraph appears to have a missing statement. "Data from well Number 106, located adjacent to ...."

  Ebasco Response

  This sentence was misplaced and has been removed.

- *Item No. 2, Figure 2-2 - TCE Contamination Upper Bedrock*

  Comment

  There is something seriously wrong with the contours shown in this figure. If the figures were correct one should ask why are we attempting to clean the upper bedrock? I believe the contours shown are for the deep bedrock. For example RS104 an upper bedrock well contained 24,000 ugm/L of TCE.

  Ebasco Response

  Figure 2-2 has been revised to include wells RS104 (16,000 ppb), RS249 (14 ppb), RS105 (970 ppb) and RS339 (2,600 ppb) as measured by Geraghty and Miller.

- *Item No. 3, Section 3.3.2.a, Page 3.3b*

  Comment

  In the first bullet the well screen should be 304 stainless steel not PVC. In the second bullet delete the last sentence which refers to the use of pilot holes.

  Ebasco Response

  These changes have been made.

- *<u>Item No. 4, Section 4.0a</u>*

  <u>Comment</u>

  A new paragraph or section needs to be included which addresses the Health and Safety Plan which has been written to permit the new sampling program to proceed.

  <u>Ebasco Response</u>

  Paragraph 4.0.c has been added.

REDSTONE ARSENAL UNIT 2
REVISED WORK PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: PORTER MORGAN
DATE: 13 APRIL 1994

- *Item No. 1, Section 3.2.2.a, First Bullet, Page 3-3b*

  Comment

  The borehole to be drilled has now been agreed to be ten (10) inches in diameter and not twelve (12) inches in diameter.

  Ebasco Response

  "twelve (12)" has been changed to "ten (10)".

REDSTONE ARSENAL UNIT 2
FIELD SAMPLING PROGRAM AND SSHP
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: WILLIAM M. TOWNSEND
DATE: 25 APRIL 1994

- *Item No. 1, Page i of SSHP*

  Comment

  The SSHP shall be signed and dated by the CIH prior to submittal. ER 385-1-92 Appendix B, paragraph 3.b.(1).

  Ebasco Response

  The final SSHP will be signed and dated by a C.I.H.

- *Item No. 2, Page ii of SSHP*

  Comment

  Add 8.5.4 Drill Rig Safety................8-4

  Ebasco Response

  8.5.4 has been added to the table of contents.

- *Item No. 3, Page 1-1 of SSHP*

  Comment

  Add USACOE regulation, ER 385-1-92

  Ebasco Response

  ER 385-1-92 has been added.

- *Item No. 4, Page 4-1 of SSHP*

  Comment

  Para. 4.1.b - The concentrations of contaminants detected from previous site investigations can be found in the Unit 2 ICM Work Plan. This information must be included in the SSHP also.

  Ebasco Response

  Table 4-1 has been added containing this information.

- *Item No. 5, Page 4-3, Table 4-1 of SSHP*

  Comment

  OSHA PEL and ACGIH TLV columns (2nd column of each, is the STEL) are confusing, 2nd column of each is not labeled.

  Ebasco Response

  Headings in Table 4-2 (previously 4-1) have been corrected.

- *Item No. 6, Page 4-8 of SSHP*

  Comment

  Conversion factor to convert F to C is incorrect. Replace 9/5 with 5/9 to correct the formula.

  Ebasco Response

  Correction has been made.

- *Item No. 7, Page 6-2, of SSHP, Table 6-1*

  Comment

  What do you do when LEL is from 11% to 20% in work zone? Non sparking tools, ventilate, increase monitoring?

  Ebasco Response

  LEL in first row of "Combustible Gas Monitoring" should be 0-20%.

- *Item No. 8, Page 21, of SSHP*

  Comment

  Your definition of level C and D, respiratory and non respiratory C and respiratory D etc., is to say the least confusing. Level C includes an air purifying respirator. If you want to add another level of PPE protection that doesn't include a respirator, then call it modified level D and describe what differentiates it from level D. See also pages 6-2, 6-3, 6-4, 6-5, etc., to see the magnitude of the confusion.

  Ebasco Response

  The levels of PPE have been redefined throughout the text.

- *Item No. 9, Page 8-3 of SSHP*

  Comment

  Para. 8.5.3.a. Confusing sentence. ......and a CGI will be used to monitoring combustible gas.... Consider will be used for monitoring.... or will be used to monitor......

  Ebasco Response

  This sentence has been revised.

- *Item No. 10, Page 6-2 of SSHP, Note 1*

  Comment

  Typo comma left out. If threatening, the action levels and PPE......

  Ebasco Response

  Comma has been added.

- *Item No. 11, Page 6-3, of SSHP*

  Comment

  Where is respirator for level C?

  Ebasco Response

  Levels of PPE have been redefined.

- *Item No. 12, Page 4-1 of SSHP*

  Comment

  Per para. 4.d. of ER 385-1-92, Appendix B "Documentation of all safety and health training including names of employees, duration, contents and dates of training shall be appended to the SSHP. ALSO, Per para. 6.d. "Certification of employees" participation in the medical surveillance program shall be appended to the SSHP". This includes names, dates, and name of reviewing physician.

  Ebasco Response

  Training and medical surveillance documentation has been added as Appendix F.

- *Item No. 13, Page 12-5 of SSHP*

  Comment

  USACE Project Managers telephone number listed is the Fax #.

  Ebasco Response

  The correct phone number now appears.

- *Item No. 14, SSHP*

  Comment

  MSDS's for material (Ex. hydrogen peroxode, bentonite, grout, Alconox, Nitric acid, etc.) brought on site, must be included.

  Ebasco Response

  MSDS's have been added as Appendix G.

REDSTONE ARSENAL UNIT 2
FIELD SAMPLING AND ANALYSIS PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: PORTER MORGAN
DATE: 13 APRIL 1994

- *Item No. 1, Section 2.2.2 Explosive Ordnance, Last Para., Page 2-2*

  Comment

  During the negotiations between the COE and Enserch we agreed that all of the well sites would be cleared for EOD prior to the start of final drilling for depth on any wells. This paragraph does not currently address that agreement.

  Ebasco Response

  Agreed. This paragraph has been reworded to more clearly describe this.

- *Item No. 2, Section 2.2.3 Test/Extraction Well Installation, First Para., Page 2-4*

  Comment

  Under no circumstances will the filter pack be placed as described. The use of a tremie pipe will be mandatory.

  Ebasco Response

  A tremie pipe will be used, as now stated.

- *Item No. 3, Section 2.2.4 Piezometer Installation, Page 2-4*

  Comment

  A minimum of two (2) piezometers will be installed at each of the three wells to be pump tested. Please specify typical distances suggested from test well.

  Ebasco Response

  As we discussed, two wells (either piezometer or existing monitoring) will be used to measure drawdown. If an existing monitoring well is not available in the appropriate location, a piezometer will be installed.

- *Item No. 4, Section 2.2.6 Well Abandonment, Second Bullet, Page 2-6*

  Comment

  This statement is to strong. Suggest it be rephrased to be a judgement factor to be used in connection with other factors. Also the wording "medium sand..." could be replaced with a potentially permeable material.

  Ebasco Response

  Paragraph has been reworded to allow more flexibility.

- *Item No. 5, Section 2.2.7 Land Survey and Water Level*

  Comment

  Regulations require 1983 as the reference for all new projects.

  Ebasco Response

  New points will reference the existing monuments located during the most recent survey at Unit 2 performed by Ebasco. Vertical control of these monuments is NGVD-29.

- *Item No. 6, Section 2.2.9.1 Soil Sampling and Analysis*

  Comment

  The one sample that will be taken from each roll-off box must be a composite sample. Suggest that at least eight (8) and possibly ten (10) samples be taken at different points in the roll-off box and composited into a single sample for chemical analysis.

  Ebasco Response

  A composite sample will be obtained, as requested.

REDSTONE ARSENAL UNIT 2
REVISED FINAL ICMD WORK PLAN AND DRAFT FIELD SAMPLING AND ANALYSIS PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: US ENVIRONMENTAL PROTECTION AGENCY
DATE: MAY 4, 1994

- <u>*General Comments*</u>

1. *The Revised Final ICMD Work Plan and Draft FSAP should evaluate the aquifer characteristics of the alluvial overburden zone and the upper bedrock zone as two separate hydrologic units even though the two zones are interconnected and comprise the unconfined aquifer. The intergranular groundwater flow through the alluvial overburden zone will vary significantly from the fracture flow characteristics of the upper bedrock zone. Therefore, groundwater in these two zones will respond differently during extraction well pumping.*

<u>Ebasco Response</u>

The portion of the overburden being screened is a weathered zone of coarse-grained sand and gravel. The alluvial overburden just above this zone is a low-permeability clay which will not yield much water. Indirect influence in the overburden will be obtained by pumping the weathered limestone zone and fractured bedrock. The portion of screen in the bedrock will capture water flowing laterally in the bedrock zone and induce migration from the overburden zone.

2a. *The Revised Final ICMD Work Plan and Draft FSAP should provide the aquifer test methods and describe the aquifer test design used to evaluate the aquifer characteristics of the alluvial overburden zone and the upper bedrock zone of the unconfined aquifer during the pumping test. Examples of the aquifer test design components which should be described include the spacing of the observation wells, duration of aquifer tests and procedures for selecting the proposed pumping test locations. The aquifer test data will be invaluable in designing and optimizing the groundwater extraction and treatment system.*

2b. *The Theis method used in the conceptual extraction well configuration should not be used to evaluate the pumping test data. The Theis method is valid for aquifers that are confined, homogenous and isotropic. These characteristics are not present in the unconfined aquifer at Unit 2; therefore, the Theis method will not yield reliable results.*

Ebasco Response

a. **Additional details have been added to describe the aquifer test and selection of wells to be tested. Pump test wells will be selected based on elevations during well development. Wells in highly contaminated zones will be targeted.**

b. **Given the information obtained during the field program, it should not be necessary to model the aquifer characteristics. Analysis will likely be performed using direct measurement.**

3. The Draft FSAP extraction well design proposes the installation of all the extraction well screens across both the alluvial overburden zone and the upper bedrock zone. Each extraction well screen interval should be evaluated individually based on the groundwater flow characteristics and contaminant concentrations at the extraction well location. Withdrawing groundwater from two different hydrologic zones in a single well will result in an ineffective extraction system for removing contaminated groundwater. For example, in extraction wells where the hydraulic conductivities is higher and contaminant concentrations lower in the upper bedrock zone, screening both zones will result in an inefficient extraction system. Under these conditions, the extraction well would be expected to pump relatively high volumes of groundwater at low contaminant concentrations, therefore increasing the water treatment costs. Furthermore, in this example, pumping groundwater from the more conductive upper bedrock zone will likely induce the flow of the highly contaminated groundwater downward into the upper bedrock zone.

Ebasco Response

Based on existing data, the overburden zone can only produce about 2 gpm. The bedrock yield will depend on the fracture conditions at the well location; however, the estimated yield is 25 gpm. To obtain the desired flow rate will require pumping the bedrock aquifer. As described above, contamination in the overburden should be captured in this manner since the aquifers are interconnected. Pumping from the overburden only would greatly increase the project duration, increasing project costs.

REDSTONE ARSENAL UNIT 2
REVISED FINAL ICMD WORK PLAN AND
DRAFT FIELD SAMPLING AND ANALYSIS PLAN
REVIEW COMMENTS AND RESPONSES

- *Specific Comments*

1a. *Page 2-2, Section 2.2.3, Paragraph 1: Existing analytical data and borehole logs from monitor wells near the proposed extraction well sites should be reevaluated to determine if all extraction wells need to extend into the upper bedrock zone. High contaminant concentrations in both the alluvial overburden zone and upper bedrock zone in the area of proposed extraction well EX-3 warrant placing the screen intervals in both these zones. However, extraction wells in other areas, such as wells EX-4, -6, -9 and -10, may not require pumping from the upper bedrock aquifer and could potentially draw more highly contaminated groundwater from the alluvial overburden zone downward into the upper bedrock zone.*

1b. *The Draft FSAP should provide the borehole test method which will be used to determine the productive zone of the aquifer. Borehole logging is proposed to determine the depth and extent of the aquifer zone (page 3-3b), Section 3.2.2.a), but should be discussed in more detail to demonstrate that the proposed method will be effective.*

Ebasco Response

a. As described above, the low permeability of the shallow overburden zone make it undesirable to pump this aquifer. Yields will come from the upper bedrock aquifer and weathered zone of the deep overburden. Pumping of the bedrock aquifer will increase the downward flow of contaminants in the overburden aquifer to the extraction well inlets under the influence of a lowered bedrock potentiometric surface. Furthermore, because of the fractured and pinnicled bedrock in the area, one well might be clean while a location 20 feet away might be contaminated.

b. Borehole logging is not proposed to determine screen depth. Screens will be set 10 to 12 feet into the limestone bedrock.

2. *Page 2-4, Section 2.2.4, Paragraph 1: The Draft FSAP should provide the distance at which piezometers (observation wells) will be installed from the pumping well. A rule of thumb for placing observation wells is to install the observation wells at incremental distances from the extraction well at one and a half times the saturated thickness of the aquifer.*

Ebasco Response

Section 2.2.4 has been expanded. Piezometers will be positioned approximately 30 feet away from the test well.

3a. *Page 2-4, Section 2.2.5, Paragraph 1: The proposed item period for running the aquifer test (24 hours) is inadequate and most likely will not produce complete drawdown data characteristic of an unconfined aquifer. The aquifer test should be performed for a minimum of 72 hours or until the last time-drawdown data is observed. The longer period of time for performing the aquifer test is required to develop late time-drawdown data. The late time-drawdown data provides increased reliably and accuracy in the horizontal and vertical hydraulic conductivities data, specific yield, storativity and boundary aquifer conditions.*

3b. *The Draft FSAP should discuss the aquifer test method(s) used to evaluate the pumping test data. The description should include procedures used to evaluate the aquifer characteristics of the alluvial overburden zone and the upper bedrock zones of the uncofined aquifer. The Theis method referenced in the Revised Final ICMD Work Plan should not be used, see General Comment 2.*

3c. *See General Comment 3 in reference to the different water-bearing zones.*

3d. *The Draft FSAP should evaluate performing a step drawdown test first to determine the discharge rates for the groundwater extraction wells. The step drawdown test should include the number of discharge rates (steps) and time period for each step.*

Ebasco Response

a. It is true that extending the pump test to 72 hours would provide more information on late-time drawdown. In this case, however, 24-hour pump tests were selected based on the short project schedule and budget constraints.

b. As discussed in General Comment #2, it is anticipated that analyses will be performed using direct measurement. The FSAP now makes reference to this in Section 1.3, page 1-3.

c. Refer to General Comment #3 response.

d. Step drawdown was evaluated. Design data can be obtained without the use of a step drawdown test.

4a. Page 2-6, Paragraph 2: This statement unnecessarily restricts the conditions for locating extraction wells. In addition, it will also be difficult to provide an accurate description of the alluvial material with which to make this decision. Drill cuttings logged from boreholes will result in mixing of soils from several horizons in the borehole, therefore making it difficult to accurately delineate the alluvial material.

4b. The Revised Final ICMD Work Plan states that every well will be logged to determine the depth and extent of the aquifer zone. A description of the logging procedures should be included in the Draft FSAP.

Ebasco Response

a. This paragraph has been revised to allow more flexibility.

b. Logging will not be performed to determine screen depth. See response to Specific Comment 1.

5. Page 2-6, Paragraph 3: The recommendation to backfill the borehole with sand or gravel is not an acceptable borehole abandonment procedure at hazardous waste sites. The Alabama Well Abandonment SOP regulations suggest restoring, as closely as possible. Also, there are well abandonment procedures which should be followed in the ECB SOPQAM (Section E.8).

Ebasco Response

Wells to be abandoned will be grouted.

6. Page 2-11, Paragraph 3: Pre- and post-preservative blank samples as well as equipment rinsate blank samples should also be collected in the field to comply with the Level III Data Quality Objectives requirements (ECB SOPQAM Section 4.3.3).

Ebasco Response

Level III DQO requirements will be adhered to.

7. *Page 2-12: The decontamination procedures are insufficient and should be revised. Use of nitric acid is acceptable if metals are the constituents of concern; however, for organic contamination, the procedures should include deionized water rinses, solvent rinses and organic-free water rinses (ECB SOPQAM Section B.8.3).*

Ebasco Response

Decon procedures have been revised.

REDSTONE ARSENAL UNIT 2
REVISED FINAL ICMD WORK PLAN AND
DRAFT FIELD SAMPLING AND ANALYSIS PLAN
REVIEW COMMENTS AND RESPONSES

COMMENTS FROM: ADEM
DATE: MAY 4, 1994

- *Comment No. 1, Section 1.3; Field Program Objectives, Paragraph 2, Sentence 2, Page 1-2*

  The latest revision is March 1994.

  Ebasco Response

  At printing of Final FSAP, the latest revision will be May 1994.

- *Comment No. 2, Section 2.2.2, Explosive Ordinance, Paragraph 4, Page 2-2*

  The procedure of drilling to a certain depth and removing the rig to check for ordinance is a great idea. What type of magnetometer are you going to use that will fit down into the well hole and actually read down into the hole. The magnetometers that are available to fit into the hole would take readings radially from the well -- not vertically in the direction of drilling.

  Ebasco Response

  A Schondstedt MG220 will be used to screen the boreholes. A hand-held Schondstedt MG72 will be used to screen surface soils.

- *Comment No. 3, Section 2.2.3, Test/Extraction Well Installation, Page 2-4*

  Paragraph 3: A tremie pipe will be used for all wells due to their depth and size. This will assure that there are no void spaces in the filter pack and the bentonite seal.

  Ebasco Response

  This paragraph has been revised. A tremie pipe will be used.

- <u>*Comment No. 4*</u>

  Paragraph 2 and 3: Provide a description of how the amount of bentonite and filter material will be calculated to assure that the proper height of material is placed in the well. This is important especially for the filter pack around the well screen.

  <u>**Ebasco Response**</u>

  All materials will be placed with a tremie pipe which will avoid bridging of materials in the well. The depth of the filter pack around the well screen will be measured with a fiberglass tape to ensure proper depth.

- <u>*Comment No. 5*</u>

  Paragraph 5: The investigation derived wastes (IDW) produced by the installation and development of these wells shall be placed in containers that may be kept on site for a maximum of 90 days. This 90 day limit applies to all IDW (e.g., soil, water, PPE, decontamination water, etc.) and begins at the time the first waste is placed into a given container (not when the container becomes full) and continues until the IDW has been tested and determined to be nonhazardous. If the IDW contained in a given container tests as hazardous, it must be properly removed and treated or disposed of within 90 days of its origination.

  <u>**Ebasco Response**</u>

  Verbiage pertaining to the 90 day limit has been added to Section 6.0.

- <u>*Comment No. 6*</u>

  Paragraph 5: Provide a minimum time that will be allowed for the bentonite and grout to seal and set prior to development and pump testing.

  <u>**Ebasco Response**</u>

  Paragraph 5 has been expanded. Bentonite and grout will be allowed to seal and set for a period of 24 hours prior to development.

- *Comment No. 7*

  Paragraph 7: This paragraph gives a brief description of the concrete pad that will be constructed. Will this pad be formed only of concrete, or will reinforcement be added too?

  Ebasco Response

  The concrete pad has been eliminated. The full-scale interim corrective measure will include the installation of a vault around each well. Therefore, installing a pad at this time would only cause additional work to remove it later. The well will be stable enough without the pad.

- *Comment No. 8*

  Paragraph 7: Provide a description of the placement of the four concrete bumpers. There should be one at each corner of the concrete pad.

  Ebasco Response

  Although the pad has been eliminated, 2 post will still be installed and brightly painted. The only purpose of these posts is to call attention to the well.

- *Comment No. 9*

  Paragraph 7: Provide a detailed description of the piezometer's placement and depth. What techniques will be used for their installation?

  Ebasco Response

  Placement of the piezometers will depend upon the availability of existing monitoring wells at each location. Piezometers will be placed in the areas not covered by monitoring wells. If no monitoring wells exist nearby, two piezometers will be installed at each pump tested well. One will be offset about 20 feet, one at about 40 feet. Piezometers will be placed from surface level down to the top of rock, which is an average 55 to 60 feet bls.

- *Comment No. 10, Section 2.2.5, Pump Testing and Specific Capacity Testing, Page 2-5*

  Paragraph 1: Sentence 4 states that the contaminated water will be contained. What will it be contained in and where will these containers be?

  Ebasco Response

  Contaminated water will be stored temporarily in "Econotanks", open top tanks with a capacity of 50,000 gallons each, or in frac tanks, enclosed steel tanks with a capacity of 20,000 gallons each. Containers will be located near the pilot treatment plant. One or more tanks may be centrally located to avoid excessive piping distances.

- *Comment No. 11*

  Paragraph 3, Sentence 4: Replace the word "about" with "above" such that the sentence reads: "...a safe distance above the pump intake."

  Ebasco Response

  The change has been made.

- *Comment No. 12*

  Paragraph 4: Define the term "nearby wells" as used here. How far away must a well be in this area to be within the radius of influence of the pumped wells? What will be done if there are no "nearby wells" -- put in piezometers?

  Ebasco Response

  Existing wells up 500 feet away may be utilized. If no wells exist, two piezometers will be installed at distances of 20 and 30 feet away from the well.

- *Comment No. 13, Section 2.2.6, Well Abandonment, Page 2-5*

  Paragraph 2: Are all wells going to be advanced with air hammer drilling? What other techniques might be used?

Ebasco Response

Air hammer drills will be used to advance the boring. Other methods such as mud rotary were considered; however, materials other than potable water and air should not be introduced into the well.

- *Comment No. 14*

Paragraph 2: The abandonment of wells should in no way allow contaminant transport through the successive strata especially below any confining layers. ADEM Well Abandonment SOP requires the well be grouted to at least the top of the uppermost confining layer using a tremie pipe. Native soil as fill is not recommended. Also, the sand/gravel used in wells where the piping has been removed must simulate, as closely as possible, the native aquifer permeability above the upper confining layer.

Ebasco Response

Wells will be abandoned by grouting from the bottom to the top.

- *Comment No. 15, Section 2.2.8, Treatability Study, Page 2-6*

Will the pilot plant discussed in this section be in place and running within 90 days from the first generation of water requiring treatment? Will well development water be treated in this pilot plant?

Ebasco Response

The treatment plant is expected to be in operation within three to four weeks of generation of contaminated water. Development, pump test, specific capacity test, and decon water all will be treated in this plant.

- *Comment No. 16*

Paragraph 6, Sentence 3: This sentence references a description of the treatment system in Section 2.2.10.4. This referenced section does not contain this information.

Ebasco Response

It should read "Section 2.2.9.4."

- *Comment No. 17, Section 2.2.9.3, Treatability Study Samples, Page 2-8*

  Sentence 1: This sentence references a Section 2.2.11 which does not exist in this plan.

  Ebasco Response

  It should read "Section 2.2.8."

- *Comment No. 18*

  Where will the treated water from the performance tests be held while waiting on the sample analysis to be returned from the lab? You cannot assume that sample analysis to be returned from the lab? You cannot assume that the treatment system has treated the water to the degree desired and release it. This is the purpose for the treatability study.

  Ebasco Response

  Treated water will be recycled through the system until lab tests indicated that treated water meets the NPDES permit criteria.

- *Comment No. 19, Section 2.2.9.4, Performance Monitoring and NPDES Samples, Page 2-8*

  Is the pilot scale treatment system the treatment system that will be used to treat the approximately 350,000 gallons of water generated by development, pump testing, and specific capacity testing?

  Ebasco Response

  Yes.

- *Comment No. 20*

  Paragraph 1, Sentence 8: This sentence references Section 6.0 for a brief discussion of NPDES permitting. This information is not in the referenced section.

  Ebasco Response

  A brief discussion of NPDES permitting is contained in Section 6.0, paragraph 3 "IDW Groundwater."

- *Comment No. 21, Section 2.2.10, Decontamination, Pages 2-11 and 2-12*

  Paragraph 3: The decontamination procedure proposed in this section is unacceptable. A procedure similar to the seven step procedure outlined in the EPA Compliance Branch Standard Operating Procedures QAM would be acceptable. The potable water described for rinsing must be changed to organic-free water. This applies to both tools and drilling equipment and to sampling equipment.

  Ebasco Response

  The decon procedure has been revised.

- *Comment No. 22, Section 5.1, Field Documentation, Page 5-1*

  Paragraph 1, Sentence 2: The driller's report should also report any shutdowns due to UXO discoveries, and any other anomalies encountered, and should include the depth at which the limestone bedrock was first encountered.

  Ebasco Response

  Additional bullets have been added accordingly.

- *Comment No. 23, Section 6.0, Investigative Derived Waste (IDW) Handling, Page 6-1*

  The investigation derived wastes (IDW) produced by the installation and development of these wells shall be placed in containers that may be kept on site for a maximum of 90 days. This 90 day limit applies to all IDW (e.g., soil, water, PPE, decontamination water, etc.) and begins at the time the first waste is placed into a given container (not when the container becomes full) and continues until the IDW has been tested and *determined to be nonhazardous. If the IDW contained in a given container tests is hazardous, it must be properly removed and treated or disposed of within 90 days of its origination, in your proposed treatment process, if groundwater removed from the wells can not be treated and the sludge removed, allowed to settle out and tested for TCLP criteria within this 90 day limit, you may wish to propose an alternate plan.*

<u>Ebasco Response</u>

Verbiage pertaining to the 90 day limit has been added.

- <u>*Comment No. 24, Section 6.0 Investigative Derived Waste (IDW) Handling, IDW Groundwater, Paragraph 1, Sentence 1, Page 6-1*</u>

  What is a "frac tank" as proposed here for groundwater storage?

  <u>Ebasco Response</u>

  The tanks that will be used are called "Econotanks" and are open-topped vessels with an impermeable liner. The tanks we intend to use are 50,000 gallons each. Frac tanks also may be used. These tanks are enclosed steel tanks with a capacity of 20,000 gallons each.

- <u>*Comment No. 25, Section 6.0, Investigative Derived Waste (IDW) Handling, IDW Sludges, Paragraph 1, Page 6-1*</u>

  The sludge must be tested prior to disposal or removal to roll-off box. These bottom sludges should not be mixed with the drill cuttings.

  <u>Ebasco Response</u>

  Sludge will be contained and tested separately from soil cuttings.

- *Comment No. 26, Section 6.0, Investigative Derived Waste (IDW) Handling, PPE and Miscellaneous Waste, Paragraph 5, Page 6-1*

  The PPE and miscellaneous wastes from each well may be determined as hazardous or nonhazardous by testing of the waste oil sampled at each particular well where that particular equipment was used. The analysis for the site as a whole should not be used as a determination of the hazardous nature of all PPE unless the entire site is determined to be hazardous.

  Ebasco Response

  All well cuttings will be contained in a single 20 CY rolloff box. One composite sample will be taken from this container to be analyzed. The results of this analysis will be used to properly dispose of the PPE.